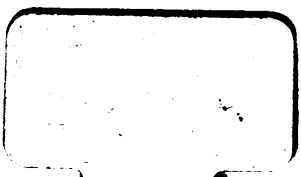


UNITED STATES TESTING

REPORT

OF THE

TESTS OF METALS

AND

OTHER MATERIALS

MADE WITH THE

UNITED STATES TESTING MACHINE AT WATERTOWN ARSENAL, MASSACHUSETTS, DURING THE FISCAL YEAR ENDED JUNE 30

1911

WASHINGTON
1912


UNITED STATES OF AMERICA
GOVERNMENT PRINTING OFFICE

LETTER OF TRANSMITTAL.

WAR DEPARTMENT,
Washington, February 17, 1912.

SIR: I have the honor to transmit herewith a letter from the Chief of Ordnance, United States Army, dated 16th instant, submitting, for transmission to Congress, as required by law, the report of the commanding officer of the Watertown Arsenal of "Tests of Iron and Steel and Other Material for Industrial Purposes," made at that arsenal during the fiscal year ended June 30, 1911.

Very respectfully,

H. L. STIMSON,
Secretary of War.

The SPEAKER OF THE HOUSE OF REPRESENTATIVES.

LETTER OF SUBMITTAL.

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ORDNANCE,
Washington, February 16, 1912.

The honorable the SECRETARY OF WAR.

SIR: I have the honor to submit for transmission to Congress, as required by law, the report of the commanding officer of Watertown Arsenal, of tests of iron and steel and other material for industrial purposes made at that arsenal during the fiscal year ended June 30, 1911 (O. O. file 37828/639).

Very respectfully,

WILLIAM CROZIER,
Brig. Gen., Chief of Ordnance.

WATERTOWN ARSENAL,
Watertown, Mass., February 15, 1912.

SIR: I have the honor to submit herewith the annual report of tests of iron, steel, and other materials made at this arsenal during the fiscal year ending June 30, 1911.

The total number of specimens tested during the year was 3,155, classified as follows:

Gun specimens	29
For Ordnance Department	1,948
For other Government departments	9
Tests for private parties	1,169
Total	3,155

The receipts and expenditures were as follows:

Amount appropriated for testing machine and testing work	$15,000.00
Received from private tests	2,947.10
Total received	17,947.10
Amount expended for services and labor	13,483.20
Amount expended for light, power, tools, implements, and material for test	4,214.13
Deposited to credit of Treasurer of United States	249.77
Total expended	17,947.10

The laboratory equipment has been improved by the installation of an electrically driven triplex pump, which is automatically controlled by the height of the accumulator weights, and which allows the machine operator to devote his whole attention to testing work. The necessary oil storage and filter tanks have been provided for use with this pump.

A number of smaller pieces of apparatus have been purchased, including an Alpha-Brinell hardness machine, a metallurgical microscope, with arc lamp and camera, and two extensometers of the Berry type.

Private tests have required more time than in previous years, and the income from them has been somewhat greater. The most important of these tests were an extended series of tensile tests of steel eyebars and those to determine the strength of riveted joints in boiler plate.

In addition to the usual routine tests of ordnance material, a number of tests were made of specimens of square steel gun wire, to obtain data regarding the elastic limit of this material.

Apparatus has been built and tests are in progress for determining the relative wearing qualities of various bronzes as a bearing metal and in the form of gears. As the conditions approximate those found in service, the wear is slight and it is necessary to continue the tests for long periods in order to obtain reliable data.

A thorough examination was made during the year of sections of an experimental jacket and "D" hoop for 14-inch gun, model of 1910, to determine the properties of the material. This work included not only tensile tests, but also a hydrostatic test and chemical and microscopical examinations.

Respectfully,

C. B. WHEELER,
Lieutenant Colonel, Ordnance Department,
United States Army, Commanding.

The CHIEF OF ORDNANCE, UNITED STATES ARMY,
Washington, D. C.

TABLE OF CONTENTS.

REPORT

OF THE

TESTS OF METALS

AND

OTHER MATERIALS

MADE WITH THE

UNITED STATES TESTING MACHINE AT WATERTOWN ARSENAL, MASSACHUSETTS, DURING THE FISCAL YEAR ENDED JUNE 30, 1911.

SQUARE STEEL WIRE FOR WINDING GUNS.

TENSILE TESTS TO DETERMINE THE ELASTIC LIMIT.

TENSILE TESTS OF SQUARE STEEL WIRE FOR WINDING GUNS.

Marks, 1–0.
Dimensions, 0.102 by 0.102 in.
Sectional area, 0.0104 sq. in.
Gauged length, 10 in.

Applied loads.		Elongation in 10 inches.				Remarks.
		Total.		Per inch.		
Total.	Per sq. in.	Elongation.	Set.	Elongation.	Set.	
Lb.	*Lb.*	*In.*	*In.*	*In.*	*In.*	
104	10,000	0.	.....	0.	0.	
208	20,000	.0048	.....	.00048	.....	
312	30,000	.0092	.....	.00092	.....	
416	40,000	.0122	.....	.00122	.....	
520	50,000	.0162	.....	.00162	.....	
624	60,000	.0200	.....	.00200	.....	
728	70,000	.0246	.....	.00246	.....	
832	80,000	.0286	.....	.00286	.....	
936	90,000	.0331	.....	.00331	.....	
1,040	100,000	.0372	.....	.00372	.....	
1,140	110,000	.0416	.....	.00416	.....	
1,250	120,000	.0468	.....	.00468	.....	
1,350	130,000	.0512	.....	.00512	.....	
1,460	140,000	.0559	.....	.00559	.....	
1,560	150,000	.0612	0.0086	.00612	.00086	
1,660	160,000	.0664	.....	.00664	.....	
1,770	170,000	.0715	.....	.00715	.....	
1,870	180,000	.0776	.....	.00776	.....	
1,980	190,000	.0854	.....	.00854	.....	
2,080	200,000	.0942	.0224	.00942	.00224	
2,520	242,000	.....	.....	.....	.....	Tensile strength.

Dimensions at fracture, 0.085 by 0.085 in.
Sectional area, 0.00722 sq. in.
Contraction of area, 30.6 per cent.
Elongation in 10 in., 0.07 in. = 0.7 per cent.
Rupture occurred 1½ in. outside of gauge mark.

Marks, 3–0.
Dimensions, 0.102 by 0.102 in.
Sectional area, 0.0104 sq. in.
Gauged length, 10 in.

Applied loads.		Elongation in 10 inches.				Remarks.
		Total.		Per inch.		
Total.	Per sq. in.	Elongation.	Set.	Elongation.	Set.	
Lb.	*Lb.*	*In.*	*In.*	*In.*	*In.*	
104	10,000	0.	0.	0.	0.	
208	20,000	.0050	.....	.00050	.....	
312	30,000	.0105	.....	.00105	.....	
416	40,000	.0165	.....	.00165	.....	
520	50,000	.0205	.0045	.00205	.00045	
624	60,000	.0245	.....	.00245	.....	
728	70,000	.0285	.....	.00285	.....	
832	80,000	.0325	.....	.00325	.....	
936	90,000	.0372	.0070	.00372	.00070	
1,040	100,000	.0415	.....	.00415	.....	
1,140	110,000	.0450	.....	.00450	.....	
1,250	120,000	.0505	.....	.00505	.....	
1,350	130,000	.0550	.....	.00550	.....	
1,460	140,000	.0595	.....	.00595	.....	
1,560	150,000	.0645	.....	.00645	.....	
1,660	160,000	.0700	.....	.00700	.....	
1,770	170,000	.0755	.....	.00755	.....	
1,870	180,000	.0815	.....	.00815	.....	
1,980	190,000	.0885	.....	.00885	.....	
2,080	200,000	.0952	.....	.00952	.....	
2,490	240,000	.....	.....	.....	.....	Tensile strength.

Dimensions at fracture, 0.082 by 0.084 in.
Sectional area, 0.0069 sq. in.
Contraction of area, 33.6 per cent.
Elongation in 10 in., 0.15 in. = 1.5 per cent.
Fractured ½ in. inside of gauge mark.

Marks, 4–0.
Dimensions, 0.10 by 0.10 in.
Sectional area, 0.01 sq. in.
Gauged length, 10 in.

Applied loads.		Elongation in 10 inches.				Remarks.
		Total.		Per inch.		
Total.	Per sq. in.	Elongation.	Set.	Elongation.	Set.	
Lb.	*Lb.*	*In.*	*In.*	*In.*	*In.*	
100	10,000	0.	0.	0.	0.	
200	20,000	.0037	.....	.00037	.....	
300	30,000	.0076	.....	.00076	.....	
400	40,000	.0114	.....	.00114	.....	
500	50,000	.0150	.0018	.00150	.00018	
600	60,000	.0185	.0018	.00185	.00018	
700	70,000	.0223	.0022	.00223	.00022	
800	80,000	.0268	.0023	.00268	.00023	
900	90,000	.0304	.0023	.00304	.00023	
1,000	100,000	.0342	.0010	.00342	.00010	
1,100	110,000	.0382	.0012	.00382	.00012	
1,200	120,000	.0422	.0019	.00422	.00019	
1,300	130,000	.0466	.0045	.00466	.00045	
1,400	140,000	.0506	.0052	.00506	.00052	
1,500	150,000	.0557	.....	.00557	.....	
1,600	160,000	.0602	.....	.00602	.....	
1,700	170,000	.0653	.....	.00653	.....	
1,800	180,000	.0709	.....	.00709	.....	
1,900	190,000	.0762	.....	.00762	.....	
2,000	200,000	.0826	.....	.00826	.....	
2,360	236,000	.....	.....	.....	.....	Tensile strength.

Dimensions at fracture, 0.08 by 0.08 in.
Sectional area, 0.0064 sq. in.
Contraction of area, 36 per cent.
Elongation in 10 in., 0.13 in. = 1.3 per cent.
Fractured 0.9 in. inside of gauge mark.

Marks, 5–0.
Dimensions, 0.104 by 0.104 in.
Sectional area, 0.0108 sq. in.
Gauged length, 10 in.

Applied loads.		Elongation in 10 inches.				Remarks.
		Total.		Per inch.		
Total.	Per sq. in.	Elongation.	Set.	Elongation.	Set.	
Lb.	*Lb.*	*In.*	*In.*	*In.*	*In.*	
108	10,000	0.	0.	0.	0.	
216	20,000	.0052	.....	.00052	.....	
324	30,000	.0093	.....	.00093	.....	
432	40,000	.0134	.....	.00134	.....	
540	50,000	.0173	.0007	.00173	.00007	
648	60,000	.0218	.....	.00218	.....	
756	70,000	.0258	.0013	.00258	.00013	
864	80,000	.0300	.....	.00300	.....	
972	90,000	.0343	.0023	.00343	.00023	
1,080	100,000	.0404	.....	.00404	.....	
1,190	110,000	.0434	.0036	.00434	.00036	
1,300	120,000	.0484	.....	.00484	.....	
1,400	130,000	.0525	.0052	.00525	.00052	
1,510	140,000	.0573	.....	.00573	.....	
1,620	150,000	.0630	.....	.00630	.....	
1,730	160,000	.0698	.....	.00698	.....	
1,840	170,000	.0756	.....	.00756	.....	
1,950	180,000	.0825	.....	.00825	.....	
2,050	190,000	.0943	.....	.00943	.....	
2,160	200,000	.1000	.....	.01000	.....	
2,500	232,000	.....	.....	.....	.....	Tensile strength.

Dimensions at fracture, 0.078 by 0.078 in.
Sectional area, 0.0061 sq. in.
Contraction of area, 43.5 per cent.
Elongation in 10 inches, 0.19 in. = 1.9 per cent.
Fractured 0.66 in. inside of gauge mark.

Marks, 15–0.
Dimensions, 0.103 by 0.103 in.
Sectional area, 0.0106 sq. in.
Gauged length, 10 in.

Applied loads.		Elongation in 10 inches.				Remarks.
		Total.		Per inch.		
Total.	Per sq. in.	Elongation.	Set.	Elongation.	Set.	
Lb.	*Lb.*	*In.*	*In.*	*In.*	*In.*	
106	10,000	0.	0.	0.	0.	
212	20,000	.0042	.....	.00042	.....	
318	30,000	.0081	.....	.00081	.....	
424	40,000	.0115	.....	.00115	.....	
530	50,000	.0155	.0002	.00155	.00002	
636	60,000	.0196	.....	.00196	.....	
742	70,000	.0234	.0007	.00234	.00007	
848	80,000	.0275	.....	.00275	.....	
954	90,000	.0312	.0013	.00312	.00013	
1,060	100,000	.0369	.....	.00369	.....	
1,170	110,000	.0402	.0022	.00402	.00022	
1,270	120,000	.0438	.0030	.00438	.00030	
1,380	130,000	.0482	.0034	.00482	.00034	
1,480	140,000	.0523	.0042	.00523	.00042	
1,590	150,000	.0583	.....	.00583	.....	
1,700	160,000	.0631	.....	.00631	.....	
1,800	170,000	.0685	.....	.00685	.....	
1,910	180,000	.0746	.....	.00746	.....	
2,020	190,000	.0820	.....	.00820	.....	
2,120	200,000	.0897	.....	.00897	.....	
2,510	237,000	.....	.....	.....	.....	Tensile strength.

Dimensions at fracture, 0.087 by 0.087 in.
Sectional area, 0.0076 sq. in.
Contraction of area, 28.3 per cent.
Elongation in 10 inches, 0.08 in. = 0.8 per cent.
Fractured 4.7 inches inside of gauge mark.

TEST 14620.

Marks, A.
Dimensions, 0.151 by 0.151 in.
Sectional area, 0.0228 sq. in.
Gauged length, 30 in.

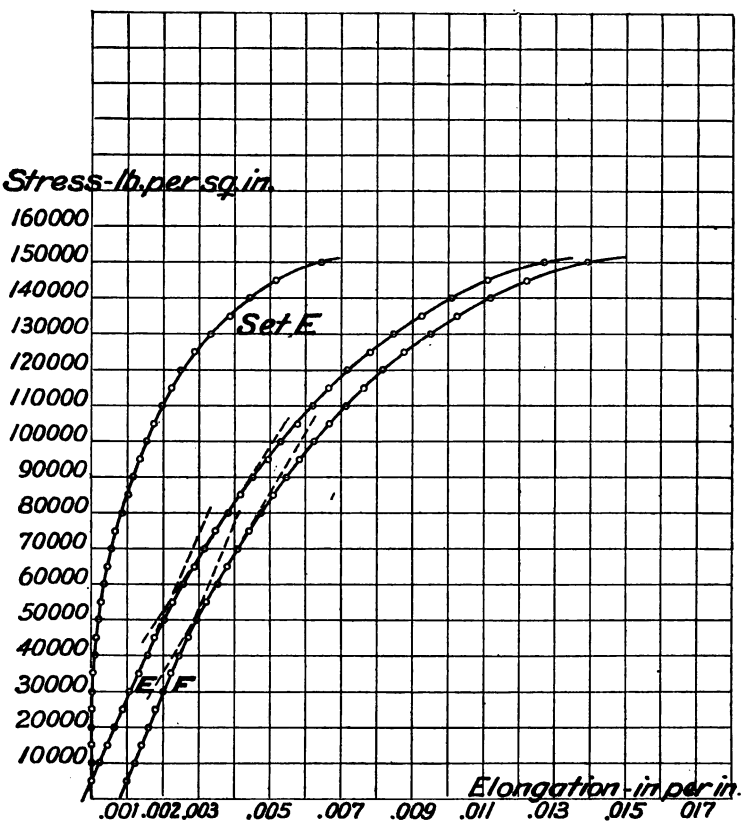
Load.	Stress per sq. in.	In gauged length.		In unit length.		Remarks.
		Elongation.	Set.	Elongation per in.	Set per in.	
Lb.	*Lb.*	*In.*	*In.*	*In.*	*In.*	
114	5,000	0.	0.	0.	.0	
228	10,000	.0060	−.0005	.00020	−.00002	
342	15,000	.0122	−.0010	.00041	−.00003	
456	20,000	.0187	−.0004	.00062	−.00001	
570	25,000	.0250	−.0001	.00083	−.00000	
684	30,000	.0316	.0002	.00105	.00001	
798	35,000	.0390	.0005	.00130	.00002	
912	40,000	.0443	.0009	.00148	.00003	
1,030	45,000	.0509	.0014	.00170	.00005	
1,140	50,000	.0580	.0023	.00193	.00008	
1,250	55,000	.0645	.0030	.00215	.00010	
1,370	60,000	.0719	.0045	.00240	.00015	
1,480	65,000	.0790	.0055	.00263	.00018	
1,600	70,000	.0869	.0078	.00290	.00026	
1,710	75,000	.0943	.0094	.00314	.00031	
1,820	80,000	.1033	.0122	.00344	.00041	
1,930	85,000	.1118	.0150	.00373	.00050	
2,050	90,000	.1212	.0183	.00404	.00061	
2,170	95,000	.1312	.0220	.00437	.00073	
2,280	100,000	.1416	.0265	.00472	.00088	
2,390	105,000	.1543	.0326	.00514	.00109	
2,510	110,000	.1675	.0390	.00558	.00130	
2,620	115,000	.1810	.0460	.00603	.00153	
2,740	120,000	.1978	.0550	.00659	.00183	
2,850	125,000	.2162	.0670	.00721	.00223	
2,960	130,000	.2380	.0819	.00793	.00273	
3,080	135,000	.2590	.0966	.00863	.00322	
3,190	140,000	.2862	.1160	.00954	.00387	
3,310	145,000	.3270	.1480	.01090	.00493	
3,420	150,000	.3830	.1949	.01280	.00650	
3,530	155,000	.5500	.3482	.01830	.01160	
3,665	160,000	.....	.....	.....	.....	Tensile strength.

Elongation after fracture, 0.40 in. in 30 in. = 1.33 per cent.
Dimensions at fracture, 0.130 by 0.130 in.
Sectional area, 0.0169 sq. in.
Contraction of area, 25.9 per cent.
Position of fracture, 3.5 in. inside of gauge mark.
Appearance of fracture, silky, cup shaped.

Marks, B.
Dimensions, 0.151 by 0.151 in.
Sectional area, 0.0228 sq. in.
Gauged length, 30 in.

Load.	Stress per sq. in.	In gauged length.		In unit length.		Remarks.
		Elongation.	Set.	Elongation per in.	Set per in.	
Lb.	*Lb.*	*In.*	*In.*	*In.*	*In.*	
114	5,000	0.	.....	0.	.....	
228	10,000	.0043	.....	.00014	.....	
342	15,000	.0101	.....	.00034	.....	
456	20,000	.0160	.....	.00053	.....	
570	25,000	.0222	.....	.00074	.....	
684	30,000	.0287	.....	.00096	.....	
798	35,000	.0350	.....	.00117	.....	
912	40,000	.0412	.....	.00137	.....	
1,030	45,000	.0480	.....	.00160	.....	
1,140	50,000	.0552	.....	.00184	.....	
1,250	55,000	.0618	.....	.00206	.....	
1,370	60,000	.0692	.....	.00231	.....	
1,480	65,000	.0764	.....	.00255	.....	
1,600	70,000	.0845	.....	.00282	.....	
1,710	75,000	.0930	.....	.00310	.....	
1,820	80,000	.1020	.....	.00340	.....	
1,930	85,000	.1110	.....	.00370	.....	
2,050	90,000	.1209	.....	.00403	.....	
2,170	95,000	.1313	.....	.00434	.....	
2,280	100,000	.1430	.....	.00477	.....	
2,390	105,000	.1568	.....	.00523	.....	
2,510	110,000	.1709	.....	.00570	.....	
2,620	115,000	.1867	.....	.00622	.....	
2,740	120,000	.2029	.....	.00676	.....	
2,850	125,000	.2219	.....	.00740	.....	
2,960	130,000	.2485	.....	.00828	.....	
3,080	135,000	.2828	.....	.00943	.....	
3,190	140,000	.3140	.....	.01050	.....	
3,310	145,000	.3640	.....	.01210	.....	
3,420	150,000	.4470	.....	.01490	.....	
3,580	157,000	.....	.....	.....	.....	Tensile strength.

Elongation after fracture, 0.38 in. in 30 in. = 1.27 per cent.
Dimensions at fracture, 0.130 by 0.130 in.
Sectional area, 0.0169 sq. in.
Contraction of area, 25.9 per cent.
Position of fracture, 3.80 in. inside of gauge mark.
Appearance of fracture, silky, cup shaped.



Test No. 14620.-Tensile tests of Square Steel Wire for winding Guns.- Determination of Elastic Limit.

TEST 14632.

Specimens G, H, I, J, K, and L were from the same coil. Specimens G, I, and K were not straightened. Specimens H, J, and K were straightened by bending about a wood block without hammering.

Marks, G.
Dimensions, 0.151 by 0.151 in.
Sectional area, 0.0228 sq. in.
Gauged length, 30 in.

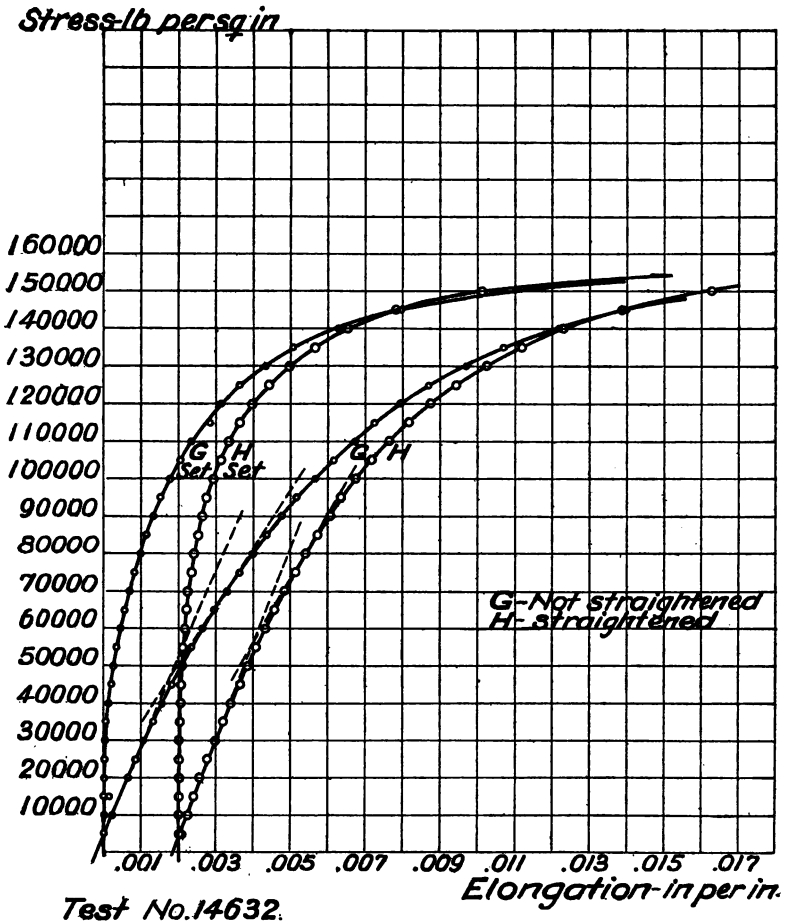
Load.	Stress per sq. in.	In gauged length.		In unit length.		Remarks.
		Elongation.	Set.	Elongation per in.	Set per in.	
Lb.	*Lb.*	*In.*	*In.*	*In.*	*In.*	
114	5,000	0.	0.	0.	0.	
228	10,000	.0069	.0005	.00023	.00002	
342	15,000	.0042	.0004	.00014	.00001	
456	20,000	.0196	.0006	.00065	.00002	
570	25,000	.0259	.0010	.00086	.00003	
684	30,000	.0325	.0017	.00108	.00006	
798	35,000	.0398	.0029	.00133	.00010	
912	40,000	.0471	.0041	.00157	.00014	
1,030	45,000	.0544	.0064	.00181	.00021	
1,140	50,000	.0622	.0083	.00207	.00028	
1,250	55,000	.0703	.0110	.00234	.00037	
1,370	60,000	.0796	.0139	.00265	.00046	
1,480	65,000	.0890	.0174	.00297	.00058	
1,600	70,000	.0989	.0209	.00330	.00070	
1,710	75,000	.1087	.0249	.00362	.00083	
1,820	80,000	.1198	.0294	.00399	.00098	
1,930	85,000	.1310	.0340	.00437	.00113	
2,050	90,000	.1430	.0396	.00477	.00132	
2,170	95,000	.1552	.0456	.00517	.00152	
2,280	100,000	.1700	.0530	.00567	.00177	
2,390	105,000	.1850	.0611	.00617	.00204	
2,510	110,000	.2020	.0708	.00673	.00236	
2,620	115,000	.2180	.0850	.00727	.00283	
2,740	120,000	.2389	.0940	.00796	.00313	
2,850	125,000	.2611	.1088	.00870	.00363	
2,960	130,000	.2910	.1300	.00970	.00433	
3,080	135,000	.3211	.1526	.01070	.00509	
3,190	140,000	.3662	.1884	.01220	.00628	
3,310	145,000	.4200	.2387	.01400	.00796	
3,476	152,500	.....	.....	.....	.....	Tensile strength.

Elongation after fracture, 0.51 in. in 30 in. = 1.7 per cent.
Dimensions at fracture, 0.128 by 0.128 in.
Sectional area, 0.0164 sq. in.
Contraction of area, 28.1 per cent.
Position of fracture, 9 in. inside of gauge mark.
Appearance of fracture, silky.

Marks, H.
Dimensions, 0.151 by 0.151 in.
Sectional area, 0.0228 sq. in.
Gauged length, 30 in.

Load.	Stress per sq. in.	In gauged length.		In unit length.		Remarks.
		Elongation.	Set.	Elongation per in.	Set per in.	
Lb.	*Lb.*	*In.*	*In.*	*In.*	*In.*	
114	5,000	0.	0.	0.	0.	
228	10,000	.0061	0.	.00020	0.	
342	15,000	.0117	0.	.00039	0.	
456	20,000	.0168	−.0002	.00056	−.00001	
570	25,000	.0231	0.	.00077	0.	
684	30,000	.0292	.0003	.00097	.00001	
798	35,000	.0356	.0009	.00119	.00003	
912	40,000	.0419	.0018	.00140	.00006	
1,030	45,000	.0489	.0024	.00163	.00008	
1,140	50,000	.0556	.0028	.00185	.00009	
1,250	55,000	.0623	.0041	.00208	.00014	
1,370	60,000	.0697	.0052	.00232	.00017	
1,480	65,000	.0773	.0068	.00258	.00023	
1,600	70,000	.0849	.0079	.00283	.00026	
1,710	75,000	.0941	.0107	.00314	.00036	
1,820	80,000	.1019	.0124	.00340	.00041	
1,930	85,000	.1115	.0157	.00372	.00052	
2,050	90,000	.1220	.0195	.00407	.00065	
2,170	95,000	.1311	.0228	.00437	.00076	
2,280	100,000	.1431	.0280	.00477	.00093	
2,390	105,000	.1553	.0336	.00518	.00112	
2,510	110,000	.1692	.0407	.00564	.00136	
2,620	115,000	.1854	.0495	.00618	.00165	
2,740	120,000	.2026	.0593	.00675	.00198	
2,850	125,000	.2229	.0725	.00743	.00242	
2,960	130,000	.2472	.0893	.00824	.00298	
3,080	135,000	.2757	.1098	.00919	.00366	
3,190	140,000	.3100	.1362	.01030	.00454	
3,310	145,000	.3560	.1753	.01190	.00584	
3,420	150,000	.4300	.2433	.01430	.00811	
3,520	154,600	....	....	....	....	Tensile strength.

Elongation after fracture, 0.24 in. in 30 in. = 0.80 per cent.
Position of fracture, 2.60 in. outside of gauge mark.
Appearance of fracture, silky.



Test No. 14632.

Tensile tests of Square Steel Wire for Winding Guns. Determination of Elastic Limit.

Marks, I.
Dimensions, 0.151 by 0.151 in.
Sectional area, 0.0228 sq. in.
Gauged length, 30 in.

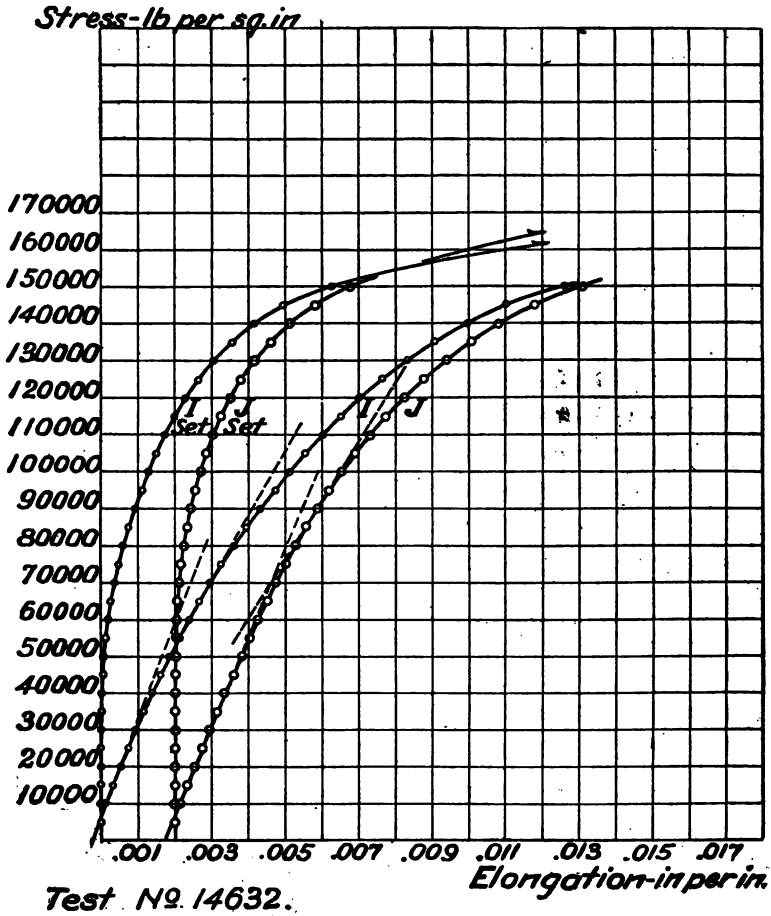
Load.	Stress per sq. in.	In gauged length.		In unit length.		Remarks.
		Elongation.	Set.	Elongation per in.	Set per in.	
Lb.	*Lb.*	*In.*	*In.*	*In.*	*In.*	
114	5,000	0.	0.	0.	0.	
228	10,000	.0038	.0001	.00013	0.	
342	15,000	.0101	.0002	.00034	.00001	
456	20,000	.0167	.0002	.00056	.00001	
570	25,000	.0223	.0004	.00074	.00001	
684	30,000	.0285	.0003	.00095	.00001	
798	35,000	.0350	.0006	.00117	.00002	
912	40,000	.0414	.0009	.00138	.00003	
1,030	45,000	.0482	.0015	.00161	.00005	
1,140	50,000	.0556	.0020	.00185	.00007	
1,250	55,000	.0634	.0038	.00211	.00013	
1,370	60,000	.0716	.0060	.00239	.00020	
1,480	65,000	.0799	.0089	.00266	.00030	
1,600	70,000	.0889	.0118	.00296	.00039	
1,710	75,000	.0979	.0150	.00326	.00050	
1,820	80,000	.1080	.0188	.00360	.00063	
1,930	85,000	.1181	.0227	.00394	.00076	
2,050	90,000	.1297	.0274	.00432	.00091	
2,170	95,000	.1427	.0339	.00476	.00113	
2,280	100,000	.1539	.0388	.00513	.00129	
2,390	105,000	.1662	.0450	.00554	.00150	
2,510	110,000	.1806	.0518	.00602	.00173	
2,620	115,000	.1960	.0598	.00653	.00199	
2,740	120,000	.2115	.0687	.00705	.00229	
2,850	125,000	.2300	.0792	.00767	.00264	
2,960	130,000	.2501	.0920	.00834	.00307	
3,080	135,000	.2724	.1069	.00908	.00356	
3,190	140,000	.2992	.1254	.00997	.00418	
3,310	145,000	.3310	.1494	.01103	.00498	
3,420	150,000	.3790	.1889	.01263	.00630	
3,675	161,200	.....	.....	.....	.....	Tensile strength.

Elongation after fracture, 0.35 in. in 30 in. = 1.17 per cent.
Dimensions at fracture, 0.132 by 0.127 in.
Sectional area, 0.0168 sq. in.
Contraction of area, 26.3 per cent.
Position of fracture, 1.45 in. outside of gauge mark.
Appearance of fracture, silky.

Marks, J.
Dimensions, 0.151 by 0.151 in.
Sectional area, 0.0228 sq. in.
Gauged length, 30 in.

Load.	Stress per sq. in.	In gauged length.		In unit length.		Remarks.
		Elongation.	Set.	Elongation per in.	Set per in.	
Lb.	*Lb.*	*In.*	*In.*	*In.*	*In.*	
114	5,000	0.	0.	0.	0.	
228	10,000	.0038	0.	.00013	0.	
342	15,000	.0096	.0001	.00032	0.	
456	20,000	.0157	.0002	.00052	.00001	
570	25,000	.0221	.0001	.00074	0.	
684	30,000	.0276	.0003	.00092	.00001	
798	35,000	.0346	.0005	.00115	.00002	
912	40,000	.0409	.0006	.00136	.00002	
1,030	45,000	.0480	.0010	.00160	.00003	
1,140	50,000	.0546	.0012	.00182	.00004	
1,250	55,000	.0609	.0017	.00203	.00006	
1,370	60,000	.0678	.0020	.00226	.00007	
1,480	65,000	.0752	.0025	.00251	.00008	
1,600	70,000	.0824	.0034	.00275	.00011	
1,710	75,000	.0904	.0056	.00301	.00019	
1,820	80,000	.0986	.0078	.00329	.00026	
1,930	85,000	.1073	.0103	.00358	.00034	
2,050	90,000	.1169	.0133	.00390	.00044	
2,170	95,000	.1261	.0171	.00420	.00057	
2,280	100,000	.1371	.0211	.00457	.00070	
2,390	105,000	.1476	.0256	.00492	.00085	
2,510	110,000	.1603	.0310	.00534	.00103	
2,620	115,000	.1731	.0378	.00577	.00126	
2,740	120,000	.1880	.0452	.00627	.00151	
2,850	125,000	.2037	.0542	.00679	.00181	
2,960	130,000	.2225	.0650	.00742	.00217	
3,080	135,000	.2430	.0787	.00810	.00262	
3,190	140,000	.2650	.0937	.00883	.00312	
3,310	145,000	.2939	.1145	.00980	.00382	
3,420	150,000	.3320	.1438	.01110	.00479	
3,742	164,100	.....	.....	.....	.....	Tensile strength.

Elongation after fracture, 0.37 in. in 30 in. = 1.23 per cent.
Position of fracture, 1.50 in. outside of gauge mark.
Appearance of fracture, fine silky.



Tensile tests of Square Steel Wire for Winding Guns. Determination of Elastic Limit.

Marks, K.
Dimensions, 0.151 by 0.151 in.
Sectional area, 0.0228 sq. in.
Gauged length, 30 in.

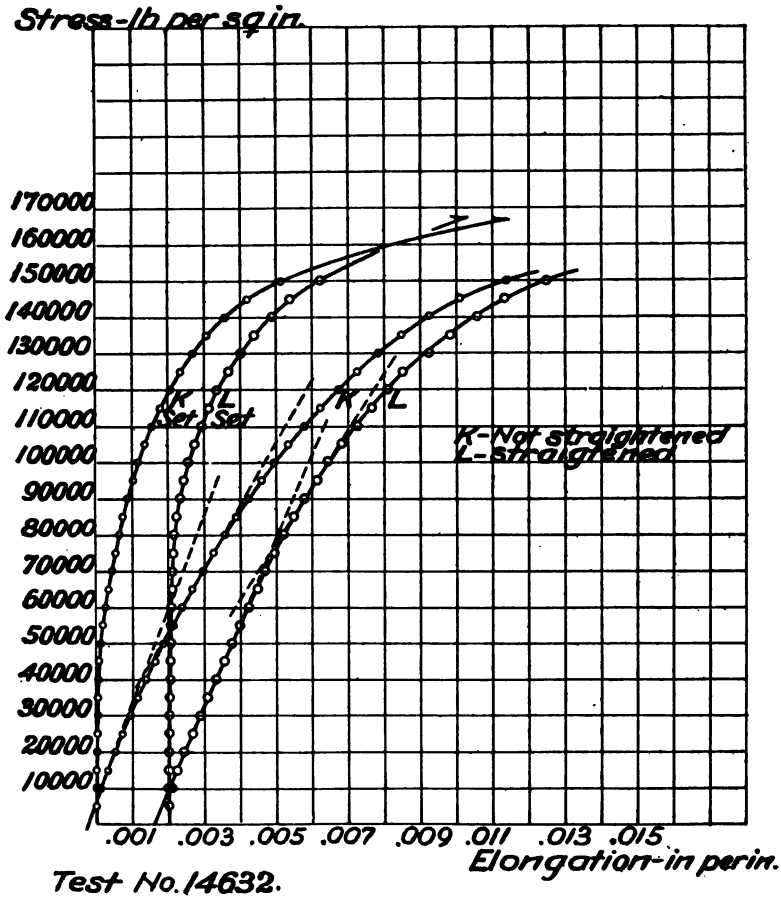
Load.	Stress per sq. in.	In gauged length.		In unit length.		Remarks.
		Elongation.	Set.	Elongation per in.	Set per in.	
Lb.	*Lb.*	*In.*	*In.*	*In.*	*In.*	
114	5,000	0.	0.	0.	0.	
228	10,000	.0030	0.	.00010	0.	
342	15,000	.0092	.0001	.00031	0.	
456	20,000	.0152	.0002	.00051	.00001	
570	25,000	.0217	.0006	.00072	.00002	
684	30,000	.0279	.0009	.00093	.00003	
798	35,000	.0342	.0012	.00114	.00004	
912	40,000	.0415	.0016	.00138	.00005	
1,030	45,000	.0486	.0023	.00162	.00008	
1,140	50,000	.0555	.0035	.00185	.00012	
1,250	55,000	.0634	.0058	.00211	.00019	
1,370	60,000	.0715	.0079	.00238	.00026	
1,480	65,000	.0798	.0107	.00266	.00036	
1,600	70,000	.0887	.0133	.00296	.00044	
1,710	75,000	.0978	.0162	.00326	.00054	
1,820	80,000	.1074	.0193	.00358	.00064	
1,930	85,000	.1165	.0228	.00388	.00076	
2,050	90,000	.1270	.0265	.00423	.00088	
2,170	95,000	.1379	.0310	.00460	.00103	
2,280	100,000	.1480	.0354	.00493	.00118	
2,390	105,000	.1606	.0410	.00535	.00137	
2,510	110,000	.1739	.0471	.00580	.00157	
2,620	115,000	.1868	.0532	.00623	.00177	
2,740	120,000	.2020	.0627	.00673	.00209	
2,850	125,000	.2184	.0704	.00728	.00235	
2,960	130,000	.2355	.0808	.00785	.00269	
3,080	135,000	.2546	.0920	.00849	.00307	
3,190	140,000	.2775	.1073	.00925	.00358	
3,310	145,000	.3029	.1259	.01010	.00420	
3,420	150,000	.3412	.1538	.01140	.00513	
3,792	166,400	.....	.....	.....	.....	Tensile strength.

Elongation after fracture, 0.55 in. in 30 in. = 1.83 per cent.
Dimensions at fracture, 0.129 by 0.129 in.
Sectional area, 0.0166 sq. in.
Contraction of area, 27.2 per cent.
Position of fracture, 6.65 in. inside of gauge mark.
Appearance of fracture, fine silky, cup shaped.

Marks, L.
Dimensions, 0.151 by 0.151 in.
Sectional area, 0.0228 sq. in.
Gauged length, 30 in.

Load.	Stress per sq. in.	In gauged length.		In unit length.		Remarks.
		Elongation.	Set.	Elongation per in.	Set per in.	
Lb.	*Lb.*	*In.*	*In.*	*In.*	*In.*	
114	5,000	0.	0.	0.	0.	
228	10,000	.0022	0.	.00001	0.	
342	15,000	.0066	.0001	.00022	0.	
456	20,000	.0128	.0002	.00043	.00001	
570	25,000	.0201	.0003	.00067	.00001	
684	30,000	.0267	.0007	.00089	.00002	
798	35,000	.0326	.0008	.00109	.00003	
912	40,000	.0393	.0009	.00131	.00003	
1,030	45,000	.0460	.0012	.00153	.00004	
1,140	50,000	.0526	.0015	.00175	.00005	
1,250	55,000	.0593	.0019	.00198	.00006	
1,370	60,000	.0666	.0024	.00222	.00008	
1,480	65,000	.0741	.0030	.00247	.00010	
1,600	70,000	.0800	.0033	.00267	.00011	Rested under initial load 20 minutes.
1,710	75,000	.0878	.0042	.00293	.00014	
1,820	80,000	.0959	.0049	.00320	.00016	
1,930	85,000	.1044	.0071	.00348	.00024	
2,050	90,000	.1138	.0108	.00379	.00036	
2,170	95,000	.1240	.0139	.00413	.00046	
2,280	100,000	.1329	.0173	.00443	.00058	
2,390	105,000	.1445	.0225	.00482	.00075	
2,510	110,000	.1581	.0284	.00527	.00095	
2,620	115,000	.1698	.0345	.00566	.00115	
2,740	120,000	.1829	.0412	.00610	.00137	
2,850	125,000	.1950	.0506	.00650	.00169	
2,960	130,000	.2175	.0608	.00725	.00203	
3,080	135,000	.2343	.0716	.00781	.00239	
3,190	140,000	.2575	.0863	.00858	.00288	
3,310	145,000	.2797	.1018	.00932	.00339	
3,420	150,000	.3140	.1274	.01050	.00425	
3,804	167,000	.....	.....	.....	.....	Tensile strength.

Elongation after fracture, 0.44 in. in 30 in. = 1.47 per cent.
Dimensions at fracture, 0.130 by 0.130 in.
Sectional area, 0.0169 sq. in.
Contraction of area, 25.9 per cent.
Position of fracture, 0.30 in. inside of gauge mark.
Appearance of fracture, fine silky.



Test No. 14632.

Tensile tests of Square Steel Wire for Winding Guns. Determination of Elastic Limit.

TEST 14722.

TENSILE TEST OF ⅛-IN. SQUARE STEEL WIRE FOR WINDING GUNS.

WIRE RECEIVED FROM WATERVLEIT ARSENAL.

Sample 1, reel 114.
Diameter of coil, free, 29-in.
Marks, 1–A.
Dimensions, 0.1275 by .1262 in.
Sectional area, 0.01609 sq. in.
Gauged length, 30 in.
Arsenal extensometer used with 6-in. dial.

Applied loads.		In gauged length.		Per inch.		Remarks.
Total.	Per square inch.	Elongation.	Set.	Elongation.	Set.	
Lb.	*Lb.*	*In.*	*In.*	*In.*	*In.*	
80	5,000	0.	0.	0.	0.	
161	10,000	.0049	0.	.00016	0.	
241	15,000	.0101	−.0002	.00034	−.00001	
322	20,000	.0157	−.0002	.00052	−.00001	
402	25,000	.0219	−.0003	.00073	−.00001	
483	30,000	.0274	−.0002	.00091	−.00001	
563	35,000	.0326	−.0003	.00109	−.00001	
644	40,000	.0385	−.0002	.00128	−.00001	
724	45,000	.0442	−.0002	.00147	−.00001	
805	50,000	.0501	−.0002	.00167	−.00001	
885	55,000	.0562	0.	.00187	0.	
965	60,000	.0623	.0002	.00208	.00001	
1,046	65,000	.0687	.0002	.00229	.00001	
1,126	70,000	.0744	.0010	.00248	.00003	
1,207	75,000	.0808	.0012	.00269	.00004	
1,287	80,000	.0879	.0020	.00293	.00007	
1,368	85,000	.0943	.0027	.00314	.00009	
1,448	90,000	.1012	.0039	.00337	.00013	
1,529	95,000	.1088	.0053	.00363	.00018	
1,609	100,000	.1161	.0067	.00387	.00022	
1,690	105,000	.1235	.0086	.00412	.00029	
1,770	110,000	.1324	.0105	.00441	.00035	
1,850	115,000	.1420	.0136	.00473	.00045	
1,931	120,000	.1512	.0169	.00504	.00056	
2,011	125,000	.1618	.0208	.00539	.00069	
2,092	130,000	.1735	.0260	.00578	.00087	
2,172	135,000	.1847	.0308	.00616	.00103	
2,253	140,000	.1985	.0380	.00662	.00127	
2,333	145,000	.2155	.0471	.00718	.00157	
2,414	150,000	.2300	.0560	.00767	.00187	
2,494	155,000	.2490	.0673	.00830	.00224	
2,574	160,000	.2707	.0809	.00902	.00270	
2,655	165,000	.2955	.0979	.00985	.00326	
2,735	170,000	.3260	.1207	.01087	.00402	
2,816	175,000	.3635	.1480	.01212	.00493	
3,230	200,700	.....	.....	.....	.....	Tensile strength.

Elongation after fracture, 0.75 in. in 30 in. = 2.5 per cent.
Dimensions at fracture, 0.101 by 0.099 in.
Sectional area, 0.0100 sq. in.
Contraction of area, 37.8 per cent.
Position of fracture, 8.30 in. inside gauge mark.
Appearance of fracture, fine silky.

From same coil as 1–A. This sample was annealed at 1,500° F. for one hour and allowed to cool slowly in furnace for about nine hours.

Marks, 1–B.
Dimensions, 0.1275 by 0.1262 in.
Sectional area, 0.01609 sq. in.
Gauged length, 30 in.

Applied loads.		In gauged length.		Per inch.		Remarks.
Total.	Per square inch.	Elongation.	Set.	Elongation.	Set.	
Lb.	*Lb.*	*In.*	*In.*	*In.*	*In.*	
48	3,000	0.	0.	0.	0.	
97	6,000	.0031	0.	.00010	0.	
145	9,000	.0068	−.0003	.00023	−.00001	
193	12,000	.0097	−.0007	.00032	−.00002	
241	15,000	.0140	−.0003	.00047	−.00001	
290	18,000	.0171	−.0002	.00057	−.00001	
338	21,000	.0204	.0001	.00068	0.	
386	24,000	.0237	.0007	.00079	.00002	
402	25,000	.0249	.0004	.00083	.00001	
418	26,000	.0264	.0003	.00088	.00001	
434	27,000	.0272	.0004	.00091	.00001	
451	28,000	.0285	.0006	.00095	.00002	
467	29,000	.0298	.0002	.00099	.00001	
483	30,000	.0304	.0008	.00101	.00003	
499	31,000	.0318	.0003	.00106	.00001	
515	32,000	.0330	.0011	.00110	.00004	
531	33,000	.0341	.0009	.00114	.00003	
547	34,000	.0354	.0005	.00118	.00002	
563	35,000	.0367	.0010	.00122	.00003	
579	36,000	.0375	.0012	.00125	.00004	
595	37,000	.0388	.0013	.00129	.00004	
611	38,000	.0400	.0015	.00133	.00005	
628	39,000	.0421	.0019	.00140	.00006	
644	40,000	.0425	.0019	.00142	.00006	
660	41,000	.0442	.0020	.00147	.00007	
676	42,000	.0459	.0021	.00153	.00007	
692	43,000	.0469	.0025	.00156	.00008	
708	44,000	.0484	.0038	.00161	.00013	
724	45,000	.0508	.0045	.00169	.00015	
740	46,000	.0519	.0049	.00173	.00016	
756	47,000	.0538	.0050	.00179	.00017	
772	48,000	.0549	.0051	.00183	.00017	
788	49,000	.0561	.0056	.00187	.00019	
805	50,000	.0578	.0057	.00193	.00019	
821	51,000	.0605	.0070	.00202	.00023	
837	52,000	.0622	.0083	.00207	.00028	
853	53,000	.0641	.0094	.00214	.00031	
869	54,000	.0670	.0101	.00223	.00034	
885	55,000	.0698	.0123	.00233	.00041	
901	56,000	.0741	.0150	.00247	.00050	
917	57,000	.0789	.0182	.00263	.00061	
933	58,000	.0850	.0228	.00283	.00076	
949	59,000	.0980	.0330	.00327	.00110	
965	60,000	.1160	.0531	.00387	.00177	
981	61,000	.1358	.0661	.00453	.00220	
998	62,000	.1521	.0793	.00507	.00264	
1,014	63,000	.1718	.0962	.00573	.00321	
1,030	64,000	.1875	.1104	.00625	.00368	
1,046	65,000	.2045	.1260	.00682	.00420	
1,062	66,000	.2235	.1415	.00745	.00472	
1,110	69,000	.2750	.1861	.00917	.00620	
1,158	72,000	.3340	.2409	.01113	.00803	
1,207	75,000	.3960	.3008	.01320	.01003	
1,725	107,200	.....	.....	.....	.....	Tensile strength.

Elongation after fracture, 1.98 in. in 30 in. = 6.6 per cent.
Dimensions at fracture, 0.109 by 0.110 in.
Sectional area, 0.0120 sq. in.
Contraction of area, 25.4 per cent.
Position of fracture, 0.80 in. inside gauge mark.
Appearance of fracture, silky 60 per cent, granular 40 per cent.

Marks, 1–C.
Dimensions, 0.1275 by 0.1262 in.
Sectional area, 0.01609 sq. in.
Gauged length, 30 in.

Applied loads.		In gauged length.		Per inch.		Remarks.
Total.	Per square inch.	Elongation.	Set.	Elongation.	Set.	
Lb.	*Lb.*	*In.*	*In.*	*In.*	*In.*	
80	5,000	0	0	0	0	
161	10,000	.0067	.0002	.00022	.00001	
241	15,000	.0114	.0002	.00038	.00001	
322	20,000	.0172	.0003	.00057	.00001	
402	25,000	.0230	−.0002	.00077	−.00001	
483	30,000	.0284	.0001	.00095	0.	
563	35,000	.0343	0	.00114	0	
644	40,000	.0403	.0007	.00134	.00002	
724	45,000	.0465	.0008	.00155	.00003	
805	50,000	.0524	.0010	.00175	.00003	
885	55,000	.0585	.0017	.00195	.00006	
965	60,000	.0647	.0023	.00216	.00008	
1,046	65,000	.0711	.0020	.00237	.00007	
1,126	70,000	.0775	.0031	.00258	.00010	
1,207	75,000	.0847	.0040	.00282	.00013	
1,287	80,000	.0911	.0050	.00304	.00017	
1,368	85,000	.0981	.0060	.00327	.00020	
1,448	90,000	.1060	.0073	.00353	.00024	
1,529	95,000	.1123	.0085	.00374	.00028	
1,609	100,000	.1203	.0102	.00401	.00034	
1,690	105,000	.1280	.0122	.00427	.00041	
1,770	110,000	.1367	.0153	.00456	.00051	
1,850	115,000	.1460	.0183	.00487	.00061	
1,931	120,000	.1557	.0216	.00519	.00072	
	125,000	.....	.....	.....	.....	Before reaching this load wire rolled over in south head into grooves in grips. Extensometer read 0.2658 when load was 125,000 lb. per sq. in. Evidently it was jarred by the shock.
3,204	199,000	.....	.....	.....	.....	= Tensile strength.

Elongation after fracture, 0.90 in. in 30 in. = 3 per cent.
Dimensions at fracture, 0.101 by 0.099 in.
Sectional area, 0.0100 sq. in.
Contraction of area, 37.8 per cent.
Position of fracture, 0.75 in. inside gauge mark.
Appearance of fracture, fine silky, cup-shaped.

Marks, 2–A.
Dimensions 0.1275 by 0.1262 in.
Sectional area, 0.01609 sq. in.
Gauged length, 30 in.

Applied loads.		In gauged length.		Per inch.		Remarks.
Total.	Per square inch.	Elongation.	Set.	Elongation.	Set.	
Lb.	*Lb.*	*In.*	*In.*	*In.*	*In.*	
80	5,000	0	0	0	0	
161	10,000	.0057	0	.00019	0	
241	15,000	.0114	0	.00038	0	
322	20,000	.0172	−.0002	.00057	−.00001	
402	25,000	.0230	.0004	.00077	.00001	
483	30,000	.0286	.0005	.00095	.00002	
563	35,000	.0341	.0008	.00114	.00003	
644	40,000	.0399	.0007	.00133	.00002	
724	45,000	.0458	.0009	.00153	.00003	
805	50,000	.0514	.0010	.00171	.00003	
885	55,000	.0571	.0015	.00190	.00005	
965	60,000	.0631	.0017	.00210	.00006	
1,046	65,000	.0690	.0023	.00230	.00008	
1,126	70,000	.0748	.0027	.00249	.00009	
1,207	75,000	.0812	.0030	.00271	.00010	
1,287	80,000	.0871	.0034	.00290	.00011	
1,368	85,000	.0931	.0041	.00310	.00014	
1,448	90,000	.1000	.0055	.00333	.00018	
1,529	95,000	.1065	.0058	.00355	.00019	
1,609	100,000	.1132	.0069	.00377	.00023	
1,690	105,000	.1120	.0071	.00373	.00024	
1,770	110,000	.1267	.0094	.00422	.00031	
1,850	115,000	.1353	.0115	.00451	.00038	
1,931	120,000	.1420	.0130	.00473	.00043	
2,011	125,000	.1517	.0165	.00506	.00055	
2,092	130,000	.1597	.0188	.00532	.00063	
2,172	135,000	.1691	.0220	.00564	.00073	
2,253	140,000	.1780	.0255	.00593	.00085	
2,333	145,000	.1880	.0296	.00627	.00099	
2,414	150,000	.1989	.0345	.00663	.00115	
2,494	155,000	.2112	.0399	.00704	.00133	
2,574	160,000	.2257	.0480	.00752	.00160	
2,655	165,000	.2393	.0545	.00798	.00182	
2,735	170,000	.2552	.0646	.00851	.00215	
2,816	175,000	.2740	.0761	.00913	.00254	
2,896	180,000	.2942	.0891	.00981	.00297	
2,977	185,000	.3190	.1064	.01063	.00355	
3,057	190,000	.3480	.1281	.01160	.00427	
3,138	195,000	.3830	.1575	.01277	.00525	
3,475	216,000	.....	.....	.....	.....	= Tensile strength.

Elongation after fracture, 0.59 in. in 30 in. = 2 per cent.
Dimensions at fracture, 0.100 by 0.103 in.
Sectional area, 0.0103 sq. in.
Contraction of area, 36 per cent.
Position of fracture, 9 in. inside gauge mark.
Appearance of fracture, fine silky.

From same coil as 2–A. This sample was annealed at 1,500° F. for about 1 hour, and allowed to cool slowly in furnace for about 9 hours. Annealed the second time at 1,500° F. for 3 hours, and allowed to cool in furnace for about 9 hours.

Marks, 2–B.
Dimensions, 0.1275 by 0.1262 in.
Sectional area, 0.01609 sq. in.
Gauged length, 30 in.

Applied loads.		In gauged length.		Per inch.		Remarks.
Total.	Per square inch.	Elongation.	Set.	Elongation.	Set.	
Lb.	*Lb.*	*In.*	*In.*	*In.*	*In.*	
48	3,000	0.	0.	0.	0.	
97	6,000	.0077	0.	.00026	0.	
145	9,000	.0116	0.	.00039	0.	
193	12,000	.0140	0.	.00037	0.	
241	15,000	.0179	−.0002	.00050	−.00001	
290	18,000	.0210	0.	.00070	0.	
338	21,000	.0239	−.0003	.00080	−.00001	
386	24,000	.0268	0.	.00089	0.	
402	25,000	.0281	0.	.00094	0.	
418	26,000	.0292	0.	.00097	0.	
434	27,000	.0298	−.0002	.00099	−.00001	
467	29,000	.0327	−.0002	.00109	−.00001	
483	30,000	.0343	−.0002	.00114	−.00001	
499	31,000	.0348	−.0002	.00116	−.00001	
515	32,000	.0353	0.	.00118	0.	
531	33,000	.0362	0.	.00121	0.	
547	34,000	.0372	−.0002	.00124	−.00001	
563	35,000	.0388	−.0003	.00129	−.00001	
579	36,000	.0396	.0008	.00132	.00003	
595	37,000	.0410	.0002	.00137	.00001	
611	38,000	.0418	0.	.00139	0.	
628	39,000	.0440	0.	.00147	0.	
644	40,000	.0451	.0001	.00150	0.	
660	41,000	.0465	.0008	.00155	.00003	
676	42,000	.0482	.0024	.00161	.00008	
692	43,000	.0501	.0024	.00167	.00008	
708	44,000	.0518	.0043	.00173	.00014	
724	45,000	.0538	.0050	.00176	.00017	
740	46,000	.0558	.0068	.00186	.00023	
756	47,000	.0623	.0099	.00208	.00033	
772	48,000	.0880	.0390	.00293	.00130	
788	49,000	.1160	.0621	.00387	.00207	
805	50,000	.1600	.0978	.00533	.00326	
821	51,000	.1880	.1230	.00627	.00410	
869	54,000	.2530	.1760	.00843	.00587	
917	57,000	.3120	.2312	.01040	.00771	
965	60,000	.3805	.2950	.01268	.00983	
1,550	96,400	.....	.....	.....	.....	Tensile strength.

Elongation after fracture, 2.76 in. in 30 in. = 9.2 per cent.
Dimensions at fracture, 0.113 by 0.114 in.
Sectional area, 0.01288 sq. in.
Contraction of area, 19.9 per cent.
Position of fracture, 0.95 in. outside gauge mark.
Appearance of fracture silky, trace of granulation.

Marks, 2–C.
Dimensions, 0.1275 by 0.1262 in.
Sectional area, 0.01609 sq. in.
Gauged length, 30 in.

Applied loads.		In gauged length.		Per inch.		Remarks.
Total.	Per square inch.	Elongation.	Set.	Elongation.	Set.	
Lb.	*Lb.*	*In.*	*In.*	*In.*	*In.*	
80	5,000	0.	0.	0.	0.	
161	10,000	.0059	0.	.00020	0.	
241	15,000	.0114	0.	.00038	0.	
322	20,000	.0170	−.0001	.00057	0.	
402	25,000	.0229	0.	.00076	0.	
483	30,000	.0282	0.	.00094	0.	
563	35,000	.0339	0.	.00113	0.	
644	40,000	.0393	0.	.00131	0.	
724	45,000	.0450	.0001	.00150	0.	
805	50,000	.0507	.0002	.00169	.00001	
885	55,000	.0568	.0004	.00189	.00001	
965	60,000	.0629	.0008	.00210	.00003	
1,046	65,000	.0681	.0009	.00227	.00003	
1,126	70,000	.0738	.0015	.00246	.00005	
1,207	75,000	.0808	.0018	.00269	.00006	
1,287	80,000	.0863	.0021	.00288	.00007	
1,368	85,000	.0931	.0030	.00310	.00010	
1,448	90,000	.0992	.0033	.00331	.00011	
1,529	95,000	.1059	.0047	.00353	.00016	
1,609	100,000	.1126	.0054	.00375	.00018	
1,690	105,000	.1181	.0060	.00394	.00020	
1,770	110,000	.1260	.0075	.00420	.00025	
1,850	115,000	.1331	.0090	.00444	.00030	
1,931	120,000	.1411	.0105	.00470	.00035	
2,011	125,000	.1479	.0125	.00493	.00042	
2,092	130,000	.1569	.0150	.00523	.00050	
2,172	135,000	.1650	.0175	.00550	.00058	
2,253	140,000	.1745	.0217	.00582	.00072	
2,333	145,000	.1840	.0243	.00613	.00081	
2,414	150,000	.1961	.0291	.00654	.00097	
2,494	155,000	.2060	.0340	.00687	.00113	
2,574	160,000	.2170	.0389	.00723	.00130	
2,655	165,000	.2315	.0457	.00772	.00152	
2,735	170,000	.2469	.0545	.00823	.00182	
2,816	175,000	.2628	.0633	.00876	.00311	
2,896	180,000	.2810	.0749	.00937	.00250	
2,977	185,000	.3025	.0904	.01008	.00301	
3,057	190,000	.3295	.1094	.01098	.00365	
3,138	195,000	.3630	.1333	.01210	.00444	
3,475	200,000	.4030	.1663	.01343	.00554	
3,511	218,300	.....	.....	.....	.....	Tensile strength.

Elongation after fracture, 0.51 in. in 30 in. = 1.7 per cent.
Dimensions at fracture, 0.098 by 0.099 in.
Sectional area, 0.0097 sq. in.
Contraction of area, 44.6 per cent.
Position of fracture, 9.35 in. inside gauge mark.
Appearance of fracture, fine silky.

SAMPLE NO. 3. REEL 778.

Diameter of coil, free, 23 in.
Marks, 3–A.
Dimensions, 0.1252 by 0.1254 in.
Sectional area, 0.01570 sq. in.
Sectional area, used as 0.01571.
Gauged length, 30 in.

Applied loads.		In gauged length.		Per inch.		Remarks.
Total.	Per square inch.	Elongation.	Set.	Elongation.	Set.	
Lb.	*Lb.*	*In.*	*In.*	*In.*	*In.*	
79	5,000	0.	0.	0.	0.	
157	10,000	.0062	0.	.00021	0.	
236	15,000	.0113	0.	.00038	0.	
314	20,000	.0170	0.	.00057	0.	
393	25,000	.0226	−.0001	.00075	0.	
471	30,000	.0281	−.0001	.00094	0.	
550	35,000	.0341	−.0001	.00114	0.	
628	40,000	.0393	−.0001	.00131	0.	
706	45,000	.0449	−.0001	.00150	0.	
785	50,000	.0502	−.0001	.00167	0.	
863	55,000	.0559	−.0001	.00186	0.	
942	60,000	.0620	−.0001	.00207	0.	
1,021	65,000	.0684	.0001	.00228	0.	
1,099	70,000	.0741	.0003	.00247	.00001	
1,178	75,000	.0758	.0006	.00253	.00002	
1,256	80,000	.0874	.0016	.00291	.00005	
1,335	85,000	.0942	.0025	.00314	.00008	
1,413	90,000	.1000	.0032	.00333	.00011	
1,492	95,000	.1070	.0038	.00357	.00013	
1,570	100,000	.1137	.0051	.00379	.00017	
1,648	105,000	.1213	.0070	.00404	.00023	
1,727	110,000	.1285	.0087	.00428	.00029	
1,806	115,000	.1377	.0112	.00459	.00037	
1,884	120,000	.1450	.0128	.00483	.00043	
1,962	125,000	.1543	.0165	.00514	.00055	
2,041	130,000	.1631	.0200	.00544	.00067	
2,120	135,000	.1746	.0243	.00582	.00081	
2,199	140,000	.1860	.0295	.00620	.00098	
2,277	145,000	.1990	.0361	.00663	.00120	
2,355	150,000	.2155	.0448	.00718	.00149	
2,433	155,000	.2406	.0614	.00802	.00205	
2,512	160,000	.2548	.0709	.00849	.00236	
2,590	165,000	.2785	.0857	.00928	.00286	
2,669	170,000	.3025	.1040	.01008	.00347	
2,748	175,000	.3389	.1307	.01130	.00436	
2,826	180,000	.3835	.1668	.01278	.00556	
3,102	197,500	.....	.....	.....	.....	Tensile strength.

Elongation after fracture, 0.34 in. in 30 in. = 1.1 per cent.
Dimensions at fracture, 0.092 by 0.096 in.
Sectional area, 0.00883 sq. in.
Contraction of area, 43.7 per cent.
Position of fracture, 1.15 in. outside gauge mark.
Appearance of fracture, silky, oblique.

14-INCH GUN, 1910.

STEEL CASTINGS FOR JACKET AND "D" HOOP.

Tensile tests of steel castings for jacket and "D" hoop for 14-in. gun, model 1910.

[The inch section in which fracture occurred is marked thus *.]

TEST 14649.

Marks, 1–4.
Diameter, 1.129 sq. in.
Sectional area, 1 sq. in.
Gauged length, 8 in.

Applied loads per sq. in.[1]	In gauged length.		Per inch.		Remarks.
	Elongation.	Set.	Elongation.	Set.	
Lb.	*In.*	*In.*	*In.*	*In.*	
1,000	0.	0.	0.	0.	
5,000	.0011	.0000	.00013	0.	
10,000	.0023	.0000	.00023	0.	
15,000	.0035	−.0003	.00044	−.00004	
20,000	.0047	−.0001	.00059	−.00001	
25,000	.0061	0.	.00076	0.	
30,000	.0077	.0000	.00096	0.	
31,000	.0079	.0000	.00098	0.	
32,000	.0081	.0000	.00101	0.	
33,000	.0085	0.	.00106	0.	
34,000	.0087	.0004	.00109	.00005	
35,000	.0092	.0003	.00115	.00004	
36,000	.0095	.0003	.00119	.00004	
37,000	.0097	.0003	.00121	.00004	
38,000	.0101	.0003	.00126	.00004	
39,000	.0103	.0002	.00129	.00003	
40,000	.0106	.0003	.00133	.00004	
41,000	.0111 / .0380	.0310	.00139 / .00475	.00388	Yield point.
71,300	.....	.....	.....	.....	Tensile strength.

[1] Total load, pounds, same as stress, pounds, per square inch.

Elongation in 8 in. = 1.84 in. = 23 per cent.

Elongation in inch sections, 0.13, 0.21, 0.28, 0.40*, 0.27, 0.22, 0.19, 0.14.

Diameter at fracture, 0.93 in.

Sectional area, 0.679 sq. in.

Contraction of area, 32.1 per cent.

Position of fracture, 4.25 in from the neck.

Appearance of fracture, amorphous; opened numerous small cavities in surface of stem; scleroscope hardness, 30.

Marks, 2–3.
Diameter, 1.129 in.
Sectional area, 1 sq. in.
Gauged length, 8 in.

Applied loads per sq. in.[1]	In gauged length.		Per inch.		Remarks.
	Elongation.	Set.	Elongation.	Set.	
Lb.	*In.*	*In.*	*In.*	*In.*	
1,000	0.	0.	0.	0.	
5,000	.0011	−.0001	.00014	−.00001	
10,000	.0023	−.0001	.00029	−.00001	
15,000	.0035	−.0001	.00044	−.00001	
20,000	.0049	−.0002	.00061	−.00003	
25,000	.0060	−.0002	.00075	−.00003	
30,000	.0074	0.	.00093	.00000	
31,000	.0079	−.0002	.00099	−.00002	
32,000	.0084	−.0001	.00105	−.00001	
33,000	.0086	0.	.00108	.00000	
34,000	.0086	−.0001	.00108	−.00001	
35,000	.0096	.0014	.00120	−.00018	
36,000	.0100	.0005	.00125	.00006	
37,000	.0100	.0003	.00125	.00004	
38,000	.0104	.0005	.00130	.00006	
39,000	.0107	.0004	.00134	.00003	
40,000	.0112	.0007	.00140	.00009	
40,300	.0116 .0780	.....	.00145 .00975	.....	Yield point.
41,000	.0849	.0757	.01060	.00946	
62,500	.....	.....	.....	.....	Tensile strength.

[1] Total load, pounds, same as stress, pounds per square inch.

Elongation in 8 in. = 0.40 in. = 5.25 per cent.
Elongation of inch sections, 0.04, 0.09*, 0.05, 0.04, 0.06, 0.05, 0.04, 0.05.
Diameter at fracture, 1.09 in.
Sectional area, 0.933 sq. in.
Contraction of area, 6.7 per cent.
Position of fracture, 1.25 in. from the neck.
Appearance of fracture, fine granular, amorphous spot at circumference; fracture contained a small cavity about 0.03 in. diameter; scleroscope hardness, 29.

Marks, 5–8.
Diameter, 1.129 in.
Sectional area, 1 sq. in.
Gauged length, 8 in.

Applied loads per sq. in.[1]	In gauged length.		Per inch.		Remarks.
	Elongation.	Set.	Elongation.	Set.	
Lb.	*In.*	*In.*	*In.*	*In.*	
1,000	0.	0.	0.	0.	
5,000	.0006	0.	.00008	0.	
10,000	.0021	0.	.00026	0.	
15,000	.0036	.0001	.00045	.00001	
20,000	.0049	.0002	.00061	.00003	
25,000	.0065	.0002	.00081	.00003	
30,000	.0080	.0003	.00100	.00004	
32,000	.0085	.0004	.00106	.00005	
34,000	.0090	.0004	.00113	.00005	
36,000	.0097	.0006	.00121	.00008	
38,000	.0760 / .0800	.0692	.00950 / .01000	.00865	Yield point.
61,000	.....	.....	.....	.....	Tensile strength.

[1] Total load, pounds, same as stress, pounds per square inch.

Elongation in 8 in. = 0.51 in. = 6.37 per cent.

Elongation of inch sections, 0.04, 0.06, 0.06, 0.06, 0.06, 0.11*, 0.06, 0.06.

Diameter at fracture, 1.08 in.

Sectional area, 0.916 sq. in.

Contraction of area, 8.4 per cent.

Position of fracture, 2.70 in. from the neck.

Appearance of fracture, granular, with a defective spot 0.10 in. wide, 0.50 in. long at the circumference; opened crack at surface of stem; scleroscope hardness, 30.

Marks, 6–7.
Diameter, 1.129 in.
Sectional area, 1 sq. in.
Gauged length, 8 in.

Applied loads per sq. in.[1]	In gauged length.		Per inch.		Remarks.
	Elongation.	Set.	Elongation.	Set.	
Lb.	*In.*	*In.*	*In.*	*In.*	
1,000	0.	0.	0.	0.	
5,000	.0008	.0002	.00010	.00003	
10,000	.0022	.0004	.00028	.00005	
15,000	.0039	.0005	.00049	.00006	
20,000	.0053	.0006	.00066	.00008	
25,000	.0066	.0006	.00083	.00008	
30,000	.0081	.0007	.00101	.00009	
31,000	[2]	.....	.....	.....	
32,000	.0089	.0010	.00111	.00013	
33,000	.0093	.0010	.00116	.00013	
34,000	.0095	.0011	.00119	.00014	
35,000	.0099	.0011	.00124	.00014	
36,000	.0102	.0011	.00128	.00014	
37,000	.0105	.0011	.00131	.00014	
38,000	.0108	.0014	.00135	.00018	
39,000	.0113	.0014	.00141	.00018	
40,000	.0116	.0014	.00145	.00018	
41,000	.0118	.0014	.00148	.00018	
42,000	.0121	.0014	.00151	.00018	
43,000	.0124	.0015	.00155	.00019	
44,000	.0126	.0015	.00158	.00019	
45,000	.0130	.0014	.00163	.00018	
46,000	.0136	.0018	.00170	.00023	
47,000	.0139	.0019	.00174	.00024	
48,000	.0142	.0018	.00178	.00023	
49,000	.0146	.0018	.00183	.00023	
50,000	.0149	.0019	.00186	.00024	
50,500	.0172 .1960	.....	.00215 .02450	.....	
51,000	.2065	.1895	.02580	.02370	
67,400	.....	.....	.....	.....	Tensile strength.

[1] Total load, pounds, same as stress, pounds per square inch. [2] Too high load.

Elongation in 8 in. = 0.76 in. = 9.50 per cent.
Elongation of inch sections, 0.12*, 0.14*, 0.09, 0.09, 0.08, 0.10, 0.07, 0.07.
Diameter at fracture, 1.02 in.
Sectional area, 0.817 sq. in.
Contraction of area, 18.3 per cent.
Position of fracture, 1 in. from the neck.
Appearance of fracture, amorphous 90 per cent, granular 10 per cent; scleroscope hardness, 29.

Marks, 9–12.
Diameter, 1.129 in.
Sectional area, 1 sq. in.
Gauged length, 8 in.

Applied loads per sq. in.[1]	In gauged length.		Per inch.		Remarks.
	Elongation.	Set.	Elongation.	Set.	
Lb.	*In.*	*In.*	*In.*	*In.*	
1,000	0.	0.	0.	0.	
5,000	.0008	0.	.00010	0.	
10,000	.0021	0.	.00026	0.	
15,000	.0035	0.	.00044	0.	
20,000	.0049	.0001	.00061	.00001	
25,000	.0063	.0002	.00079	.00003	
30,000	.0077	.0002	.00096	.00003	
31,000	.0081	.0003	.00101	.00004	
32,000	.0084	.0004	.00105	.00005	
33,000	.0086	.0003	.00108	.00004	
34,000	.0089	.0003	.00111	.00004	
35,000	.0092	.0003	.00115	.00004	
36,000	.0096	.0004	.00120	.00005	
37,000	.0097	.0004	.00121	.00005	
38,000	.0098	.0004	.00123	.00005	
39,000	.0104	.0004	.00130	.00005	
40,000	.0106	.0005	.00133	.00006	
40,900	.0112 .1387	.....	.00140 .01730	.....	
41,000	.1432	.1301	.01790	.00224	
61,300	.....	.....	.....	.....	Tensile strength.

[1] Total load, pounds, same as stress, pounds per square inch.

Elongation in 8 in., =0.71 in. =8.87 per cent.
Elongation of inch sections, 0.05, 0.07, 0.08, 0.08, 0.21*, 0.09, 0.07, 0.06.
Diameter at fracture, 1.04 in.
Sectional area, 0.849 sq. in.
Contraction of area, 15.1 per cent.
Position of fracture, 3.50 in. from the neck.
Appearance of fracture, silky 85 per cent; fine granular 15 per cent; oblique; opened cracks in surface of stem; scleroscope hardness, 27.5.

Marks, 10–11.
Diameter, 1.129 in.
Sectional area, 1 sq. in.
Gauged length, 8 in.

Applied loads per sq. in.[1]	In gauged length.		Per inch.		Remarks.
	Elongation.	Set.	Elongation.	Set.	
Lb.	*In.*	*In.*	*In.*	*In.*	
1,000	0.	0.	0.	0.	
5,000	.0009	0.	.00011	0.	
10,000	.0023	.0001	.00029	.00001	
15,000	.0038	.0002	.00048	.00003	
20,000	.0051	.0001	.00064	.00001	
25,000	.0066	.0002	.00083	.00003	
30,000	.0078	.0002	.00098	.00003	
31,000	.0081	.0002	.00101	.00003	
32,000	.0083	.0002	.00104	.00003	
33,000	.0086	.0003	.00108	.00004	
34,000	.0089	.0001	.00111	.00001	
35,000	.0091	.0002	.00114	.00003	
36,000	.0094	.0002	.00118	.00003	
37,000	.0096	.0002	.00120	.00003	
38,000	.0099	.0002	.00124	.00003	
39,000	.0101	.0002	.00126	.00003	
40,000	.0106	.0001	.00133	.00001	
41,000	.0109	.0003	.00136	.00004	
41,600	.0112 .1688	.....	.00140 .02110	.....	
42,000	.1742	.1610	.02180	.02010	
61,300	.....	.....	.....	.....	Tensile strength.

[1] Total load, pounds, same as stress, pounds per square inch.

Elongation in 8 in. = 0.92 in. = 11.50 per cent.
Elongation of inch sections, 0.08, 0.11, 0.12, 0.16, 0.19*, 0.10, 0.09, 0.07.
Diameter at fracture, 1.02 in.
Sectional area, 0.817 sq. in.
Contraction of area, 18.3 per cent.
Position of fracture, 4.30 in. from the neck.
Appearance of fracture, fine granular 90 per cent, amorphous 10 per cent; opened cracks in surface of stem; scleroscope hardness, 29.

TENSILE TESTS FROM JACKET AND "D" HOOP FOR 14-INCH GUN, MODEL OF 1910.

Ex. 0.7323 marks.	Elastic limit per sq. in.	Tensile strength per sq. in.	Elongation in 2 in.	Elongation in inch sections.		Contraction of area.	Sclero-scope hardness.	Appearance of fracture.
	Lb.	*Lb.*	*Per ct.*	*In.*		*Per ct.*		
7323T1	42,000	60,000	6.5	0.05	0.08*	9.5	24.5	Flaky, with smooth lustrous spot near circumference.
T2	41,000	72,500	27.0	.37*	.17	43.3	24.5	Dull silky.
T3	41,500	71,000	15.0	.12	.18*	24.0	23.5	Dull silky with granular metal near center; opened cracks in surface of stem.
T4	41,000	72,000	24.5	.29	.20	34.0	24.5	Dull silky.
T5	39,500	71,000	19.0	.24*	.14	24.0	25.0	Dull silky with granular metal near circumference; opened cracks in surface of stem.
T6	48,500	70,500	21.0	.22*	.20	27.4	24.5	Dull silky, with opened cracks in surface of stem.
T7	50,000	71,000	25.0	.34*	.16	37.1	24.5	Dull silky with patch of light colored metal.
T8	39,500	70,500	15.5	.20*	.11	20.5	24.0	Dull silky, with opened cracks in surface of stem.
T9	47,000	70,500	14.0	.17*	.11	16.9	24.0	Amorphous 90 per cent, granular 10 per cent.
T10	46,500	68,000	25.0	.22	.28*	37.1	24.5	Dull silky; opened cracks in surface of stem.
T11	44,500	68,000	19.0	.23*	.15	27.4	23.5	Amorphous 95 per cent, granular 5 per cent.
T12	44,500	70,000	14.0	.18*	.10	20.5	24.0	Amorphous 95 per cent, granular 5 per cent; opened cracks in surface of stem.
L1	42,500	73,200	21.0	.24*	.18	27.4	24.5	Amorphous with two small greenish colored spots.
L2	42,000	70,500	17.0	.15	.19*	20.5	24.5	Amorphous trace of granulation; open cracks in surface of stem.
L3	42,500	72,000	18.0	.22*	.14	27.4	24.0	Amorphous; opened cracks in surface of stem.
L4	40,000	71,000	14.0	.13	.15*	13.2	25.0	Fine granular 90 per cent, amorphous 10 per cent.
L5	40,000	69,000	15.5	.11	.20*	27.4	24.5	Dull silky, granular spot near circumference; opened cracks in surface of stem.
L6	47,500	61,000	9.0	.14*	.04	24.0	26.0	Dull silky with light colored spot, granular near circumference.
L7	48,500	70,500	24.0	.17	.31*	30.7	24.5	Dull silky with light colored spot at circumference.
L8	41,500	71,000	14.5	.19*	.10	24.0	25.0	Amorphous 95 per cent, granular 5 per cent.
L9	48,000	70,500	14.0	.17*	.11	20.5	25.0	Amorphous; opened cracks in surface of stem.
L10	47,000	68,500	27.5	.21	.34*	40.3	25.0	Dull silky.
L11	46,500	69,000	20.5	.25*	.16	27.4	24.5	Amorphous; opened cracks in surface of stem.
L12	47,500	71,000	16.5	.14	.19*	24.0	26.0	Do.
R1	37,000	64,000	8.5	.08	.09*	13.2	22.0	Amorphous 90 per cent, granular 10 per cent.
R2	38,500	71,500	30.0	.24	.36*	46.2	22.5	Dull silky.
R3	41,500	70,000	20.0	.18	.22*	27.4	23.0	Do.
R4	42,000	72,500	28.5	.22	.35*	43.3	23.5	Do.
R5	41,500	71,000	30.5	.19	.42*	54.6	26.0	Silky.
R6	36,000	40,500	6.0	.04	.08*	13.2	25.0	Amorphous 60 per cent, smooth lustrous 40 per cent
R7	44,500	56,000	7.5	.12*	.03	16.9	25.5	Amorphous with granular metal; brownish colored section at circumference.
R8	36,500	58,500	6.5	.09*	.04	9.5	25.0	Granular 70 per cent, amorphous 30 per cent.
R9	44,500	69,000	15.0	.18*	.12	16.9	21.5	Dull silky 90 per cent, granular 10 per cent.
R10	40,000	65,500	14.0	.11	.17*	24.0	21.5	Amorphous 90 per cent, granular 10 per cent.
R11	42,500	61,500	10.0	.13*	.07	20.5	22.0	Do.
R12	42,500	61,500	10.0	.07	.13*	16.9	23.0	Amorphous.

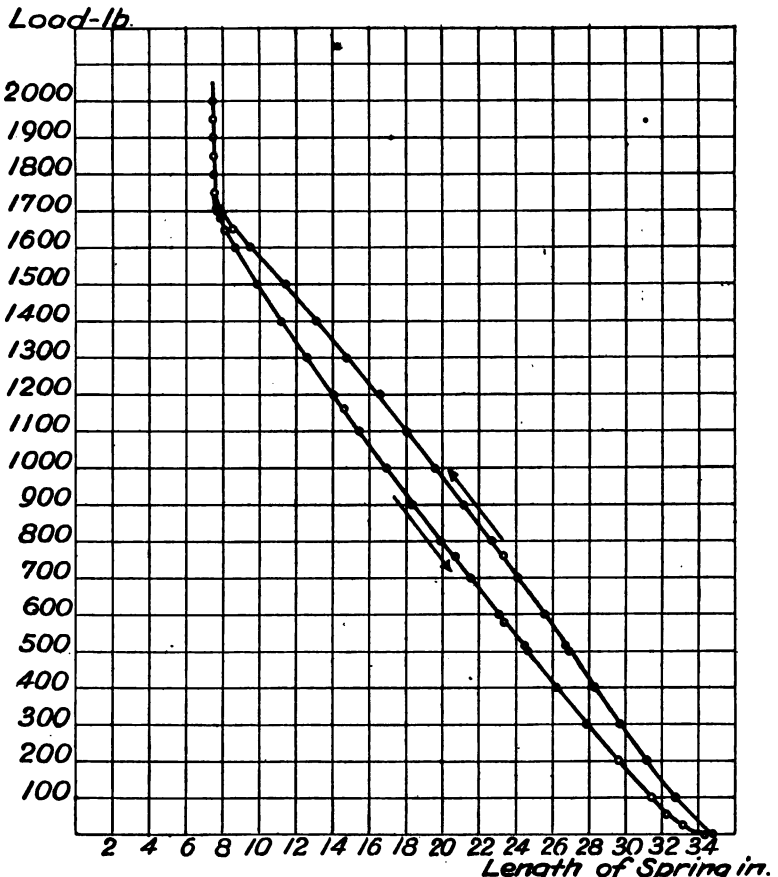
SPRINGS FOR ORDNANCE WORK.

TEST No. 14564.

Compressive tests of counter-recoil springs, 3-inch gun.
Carriage model 1902.
Plate XX. Drawing 91.
Requirements for springs (see drawing 2–16–91).
To sustain a load of 516 lb. at a height of not less than 23.33 in.
To become solid under a load of approximately 1,164 lb. at a height of not over 7.85 in.
To enter over a bar 3 in. in diameter when free.
To measure not over 5.56 in. outside diameter when solid.
Tag marked, Rear spring, carriage 172.
Spring marked, 210.

Load.	(a) Height measured on—		Height measured on—	
	Ascending load.	Descending load.	Ascending load.	Descending load.
Lb.	*In.*	*In.*	*In.*	*In.*
Free height.	34.70	34.44	34.80	34.40
25	.....	.....	.....	33.15
50	.....	.....	.....	32.22
100	32.85	.....	32.74	31.46
200	31.30	.....	31.19	29.61
300	29.97	.....	29.73	27.89
400	28.60	.....	28.33	26.23
500	.....	.....	26.90	24.69
516	26.93	.....	26.70	24.52
579	.....	.....	.....	23.33
600	25.60	.....	25.60	23.05
700	24.03	.....	24.12	21.59
759	23.33	.....	23.33	20.70
800	22.70	.....	22.70	19.92
900	21.10	.....	21.20	18.38
1,000	19.55	17.28	19.62	16.98
1,100	.....	.....	18.03	15.52
1,164	.....	.....	17.90	14.68
1,200	16.43	.....	16.66	14.11
1,300	.....	.....	14.80	12.70
1,400	12.98	.....	13.12	11.24
1,500	.....	.....	11.45	9.91
1,600	9.47	8.72	9.46	8.65
1,650	.....	8.20	8.56	8.10
1,700	.....	7.74	7.95	7.68
1,708	.....	.....	7.85	7.66
1,750	.....	7.56	7.60	7.54
1,800	.....	7.52	7.54	7.51
1,850	.....	.....	7.51	7.49
1,900	.....	7.47	7.49	7.48
1,950	.....	.....	7.48	7.48
2,000	.....	7.46	7.47	.....
2,100	.....	7.44	.....	.....
2,300	.....	7.42	.....	.....
2,500	.....	7.41	.....	.....
3,650	.....	7.40	.....	.....
3,850	7.40	.....	.....	.....

(a) Free height after dropping on floor two or three times 34.70 inches.
Outside diameter when solid, 5.53 in.



Test No. 14564

Compressive test of Counter Recoil Spring Rear; steel spring mark 210, in 3-in. carr. No. 172.

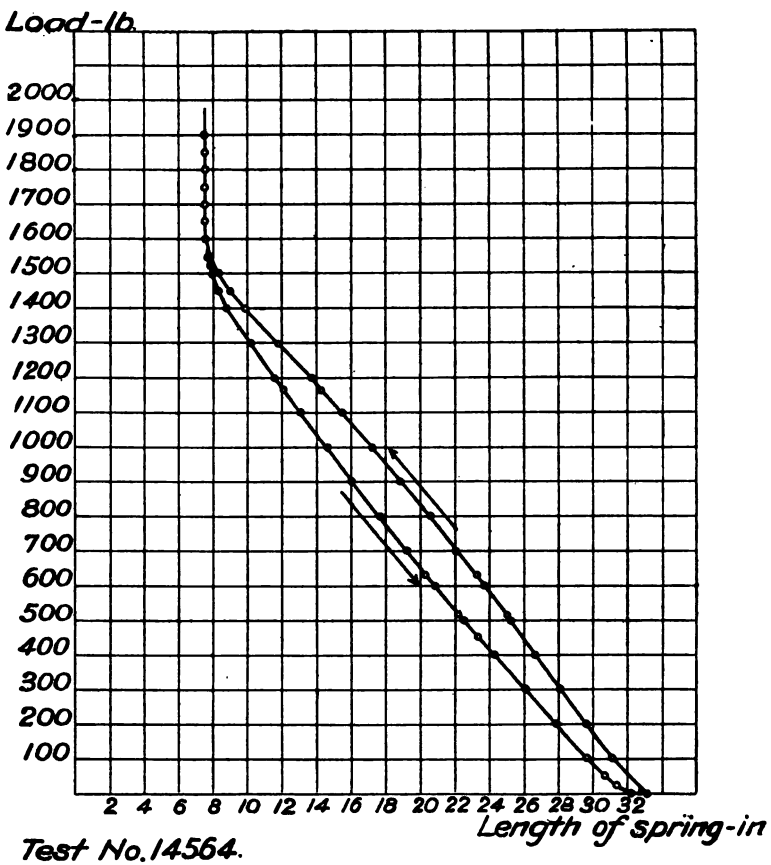
Tag marked, Middle spring carriage 172.
Spring marked, 166.

Load.	(a) Height measured on ascending load.	(b) Height measured on—	
		Ascending load.	Descending load.
Lb.	*In.*	*In.*	*In.*
Free height.	32.00	33.18	32.25
25	.....	.....	31.40
50	.....	.....	30.69
100	.....	31.08	29.62
200	28.12	29.66	27.88
300	.....	28.12	26.09
400	25.20	26.71	24.30
452	.....	.....	23.33
500	.....	25.18	22.50
516	23.57	25.04	22.20
600	.....	23.67	20.94
630	.....	23.33	20.36
700	20.62	22.12	19.29
800	.....	20.60	17.68
900	17.48	18.88	16.05
1,000	.....	17.14	14.71
1,100	.....	15.45	13.14
1,164	.....	14.26	12.11
1,200	12.35	13.72	11.50
1,300	.....	11.79	10.15
1,400	9.02	9.90	8.79
1,450	.....	9.00	8.32
1,500	7.84	8.23	7.98
1,524	.....	.....	7.85
1,548	.....	7.85	7.74
1,550	7.65	.....	.....
1,600	7.54	.....	7.57
1,650	7.50	7.55	7.53
1,700	7.49	7.54	7.52
1,750	7.46	7.52	7.50
1,800	7.45	7.50	7.49
1,850	7.44	7.49	7.48
1,900	.....	7.48	.....

Outside diameter when solid, 5.53 in.

(*a*) Free height after removing from machine, 31.95 in.; after dropping on floor two or three times, 33 in.

(*b*) Free height after removing from machine, 32.25 in.



Test No. 14564.

Compressive test of Counter Recoil Spring. Middle, steel spring mark 166 in 3-in. carr. No. 72

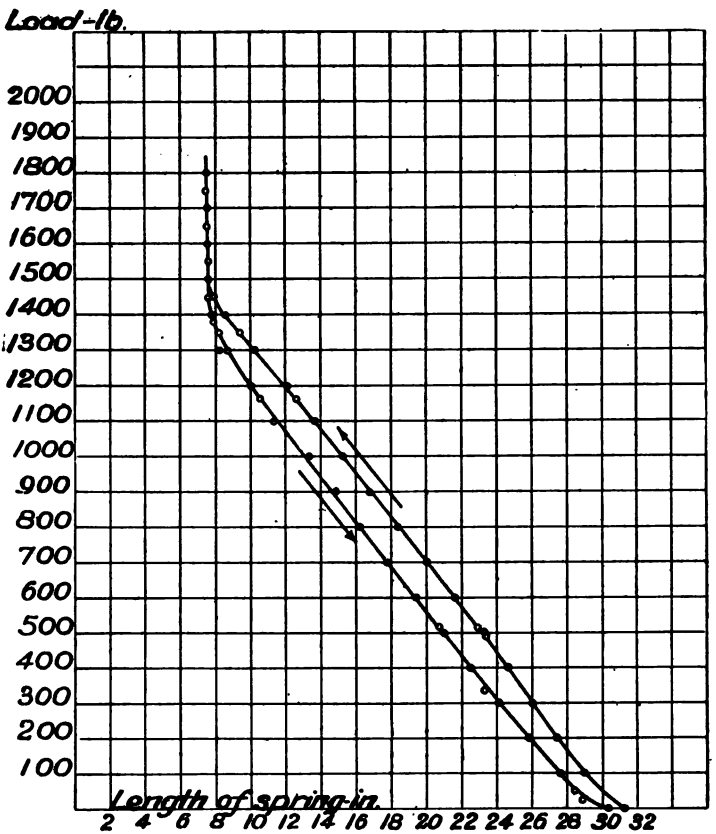
Tag marked, Front spring carriage 172.
Spring marked, 199.

Load.	(a) Height measured on ascending load.	(b) Height measured on—	
		Ascending load.	Descending load.
Lb.	*In.*	*In.*	*In.*
Free height.	30.40	31.22	30.40
25	.....	.....	28.85
50	.....	.....	28.45
100	.....	28.98	27.63
200	26.52	27.42	25.85
300	25.03	26.08	24.10
337	.....	.....	23.33
400	23.59	24.61	22.52
415	23.33	.....	.....
493	.....	23.33	.....
500	.....	23.28	21.00
516	21.80	22.93	20.76
600	20.40	21.62	19.40
700	.....	20.05	17.83
800	17.32	18.42	16.27
900	.....	16.84	14.90
1,000	14.20	15.30	13.38
1,100	.....	13.61	11.37
1,164	11.45	12.62	10.53
1,200	11.00	12.13	10.03
1,350	.....	9.40	8.22
1,378	7.85	.....	.....
1,380	.....	.....	7.85
1,400	7.70	8.53	7.78
1,450	7.60	7.85	7.64
1,500	7.56	7.60	7.58
1,550	7.53	7.58	7.54
1,600	7.51	7.55	7.52
1,650	7.49	7.53	7.50
1,700	7.48	7.51	7.49
1,750	7.47	7.49	7.48
1,800	.....	7.48	.....

Outside diameter when solid, 5.53 in.

(*a*) Free height after removing from testing machine, 30.03 in.; after dropping on floor two or three times, 31.25 in.

(*b*) Free height after removing from testing machine, 30.40 in.



Test No. 14564. Compressive test of Counter Recoil Spring. Front, steel, spring mark 199 in. 3-in. carr. no. 172

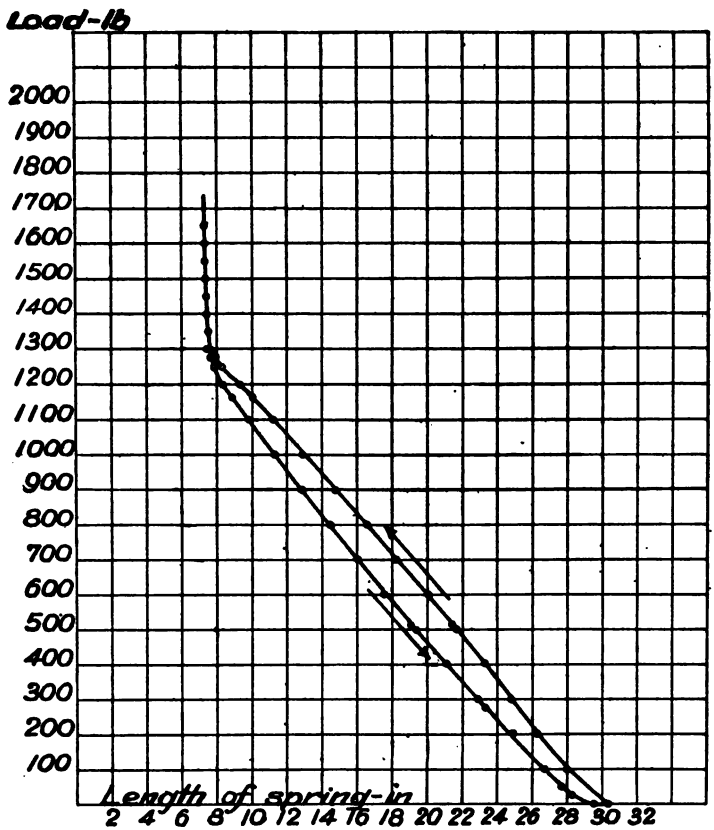
Tag marked, Front spring carriage 186.
Spring marked, 161.

Load.	(a) Height measured on ascending load.	(b) Height measured on—	
		Ascending load.	Descending load.
Lb.	*In.*	*In.*	*In.*
Free height..	29.20	30.38	29.55
25	.....	.....	28.28
50	.....	.....	27.70
100	.....	27.98	26.72
200	25.00	26.27	24.92
278	.....	.....	23.33
300	23.49	24.80	22.92
320	23.33	.....	.....
400	21.82	.....	.....
404	.....	23.33	21.12
500	.....	21.68	19.35
516	20.06	21.45	19.03
600	18.78	20.05	17.59
700	.....	18.23	16.05
800	15.31	16.62	14.51
900	.....	14.90	12.93
1,000	11.60	12.90	11.35
1,100	.....	11.28	9.81
1,164	9.20	10.10	8.88
1,200	9.00	9.32	8.37
1,250	8.00	8.32	7.85
1,270	7.85	.....	.....
1,277	.....	7.85	7.61
1,300	7.55	7.66	7.51
1,350	7.45	7.48	7.43
1,400	7.41	7.42	7.40
1,450	7.40	7.39	7.37
1,500	7.38	7.37	7.36
1,550	7.36	7.36	7.35
1,600	7.35	7.34	7.34
1,650	7.34	7.33	.....

Outside diameter when solid, 5.53 in.

(*a*) Free height after removing from testing machine, 29 in.; after dropping on floor two or three times, 30.25 in.

(*b*) Free height after removing from testing machine, 29.55 in.



Test No. 14564 Compressive test of Counter Recoil Spring Front, steel spring mark 161, in. 3-in. corr. no. 186.

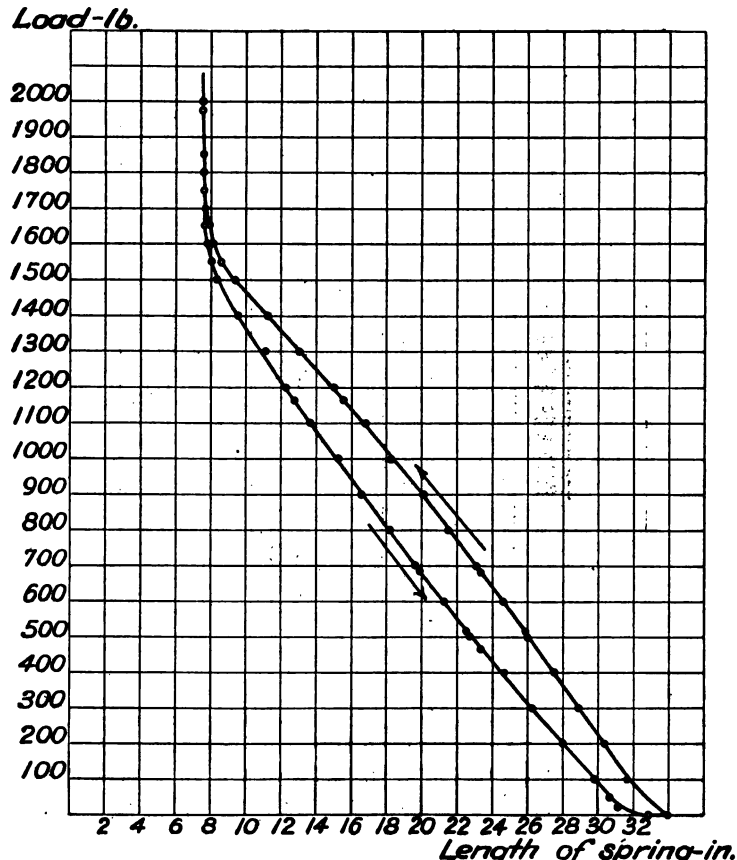
Tag marked, Middle spring carriage 186.
Spring marked, 165.

Load.	(*a*) Height measured on ascending load.	(*b*) Height measured on—	
		Ascending load.	Descending load.
Lb.	*In.*	*In.*	*In.*
Free height...	33.85	34.00	32.89
25	.....	.....	31.11
50	.....	.....	30.68
100	.....	31.70	29.80
200	29.83	30.38	27.99
300	.....	28.92	26.24
400	27.06	27.49	24.72
466	.....	.....	23.33
500	.....	26.00	22.78
516	25.57	25.92	22.56
600	24.28	24.60	21.25
665	23.33	.....	.....
685	.....	23.33	19.90
700	.....	23.10	19.65
800	21.18	21.52	18.24
900	.....	20.01	16.58
1,000	17.97	18.30	15.27
1,100	.....	16.80	13.62
1,164	15.10	15.59	12.79
1,200	14.70	15.00	12.28
1,300	12.50	13.05	11.10
1,400	10.57	11.22	9.57
1,450	9.48	.....	.....
1,500	8.70	9.40	8.35
1,550	8.12	8.50	8.05
1,600	7.85	8.16	7.85
1,650	7.70	.....	.....
1,652	.....	7.85	7.70
1,700	7.64	7.73	7.62
1,750	7.60	7.65	7.61
1,800	7.59	7.62	7.59
1,850	7.58	7.60	7.58
1,900	7.57	.....	.....
1,976	.....	7.56	7.56
2,000	.....	7.56	.....

Outside diameter when solid, 5.53 in.

(*a*) Free height after removing from testing machine, 32.65 in.; after dropping on floor two or three times, 33.98 in.

(*b*) Free height after removing from testing machine, 32.89 in.



Test No. 14620.

Compressive test of Counter Recoil Spring. Middle, steel spring mark 165 in. 3-in. carr. no. 186.

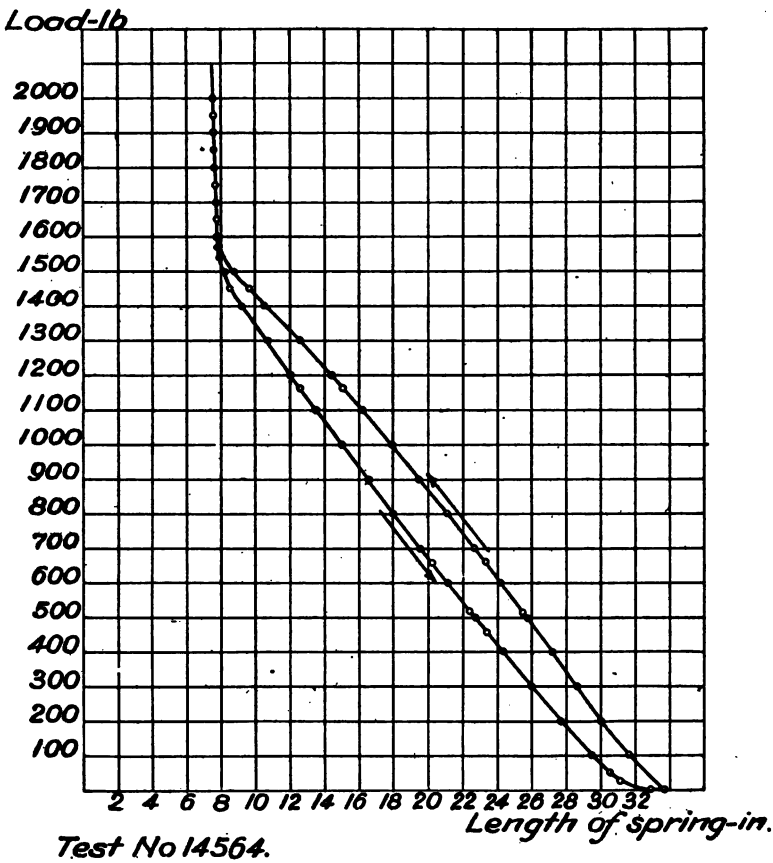
Tag marked, Rear spring carriage 186.
Spring marked, 187.

Load.	(a) Height measured on ascending load.	(b) Height measured on—	
		Ascending load.	Descending load.
Lb.	*In.*	*In.*	*In.*
Free height...	32.58	33.75	32.85
25	.....	.....	31.17
50	.....	.....	30.58
100	.....	31.62	29.53
200	28.81	29.98	27.70
300	.....	28.70	26.02
400	25.80	27.21	24.30
457	.....	.....	23.33
500	.....	25.75	22.73
516	24.33	25.50	22.42
588	23.33	.....	.....
600	.....	24.17	21.10
660	.....	23.33	20.22
700	.....	22.65	19.52
800	20.25	21.10	17.95
900	.....	19.49	16.65
1,000	17.09	17.98	15.00
1,100	.....	16.26	13.51
1,164	14.95	15.12	12.57
1,200	14.19	14.46	12.03
1,300	12.60	12.55	10.75
1,400	11.24	10.57	9.21
1,450	9.80	9.63	8.57
1,500	9.38	8.80	8.28
1,540	.....	.....	7.85
1,550	8.30	7.98	.....
1,570	.....	7.85	7.73
1,595	7.85	.....	.....
1,600	.....	7.72	7.70
1,650	7.75	7.70	7.65
1,700	7.72	7.67	7.62
1,750	7.68	7.64	7.60
1,800	7.66	7.62	7.58
1,850	7.64	7.60	7.57
1,900	7.61	7.56	7.57
1,950	7.58	7.57	7.56
2,000	7.58	7.56	.....
2,050	7.57	.....	.....

Outside diameter when solid, 5.53 in.

(*a*) Free height after removing from testing machine, 32.48 in.; after dropping on floor two or three times, 33.80 in.

(*b*) Free height after removing from testing machine, 32.85 in.



Test No 14564.

Compressive test of Counter Recoil Spring Rear, steel spring mark 187 in. 3-in. carr. no. 186.

TEST 14607.

Compression test of a counter-recoil spring, 3-inch gun carriage, model of 1902. New spring taken from stock.

Requirements (drawing 2–16–91): To sustain a load of 516 lb. at a height of not less than 23.33 in.; to become solid under a load of approximately 1,164 lb. at a height of not over 7.85 in.; to enter over a bar 3 in. in diameter when free; to measure not over 5.56 in. outside diameter when solid.

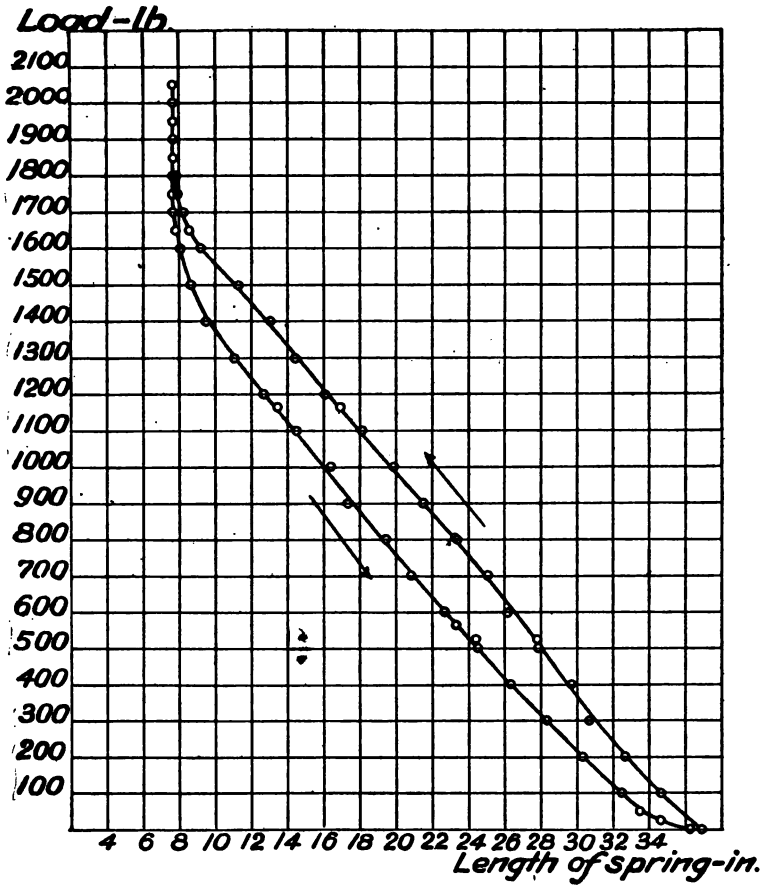
Marks on spring, 24.

Free height, 36.93 in.

Load.	Height measured on—		Load.	Height measured on—	
	Ascending load.	Descending load.		Ascending load.	Descending load.
Lb.	*In.*	*In.*	*Lb.*	*In.*	*In.*
000	36.93	36.21	1,164	16.94	13.50
25	.....	34.61	1,200	16.07	12.67
50	.....	33.46	1,300	14.41	11.09
100	34.65	32.44	1,400	13.17	9.57
200	32.63	30.29	1,500	11.31	8.68
300	30.68	28.33	1,600	9.24	8.10
400	29.64	26.34	1,650	8.57	7.85
500	27.90	24.52	1,700	8.28	7.73
516	27.80	24.38	1,750	7.95	7.71
565	.....	23.33	1,781	7.85	7.70
600	26.20	22.72	1,800	7.83	7.69
700	25.08	20.82	1,850	7.73	7.67
800	23.39	19.46	1,900	7.70	7.67
806	23.33	.....	1,950	7.69	7.67
900	21.77	17.75	2,000	7.68	7.67
1,000	19.85	16.39	2,050	7.67	.....
1,100	18.06	14.50			

Outside diameter when solid, 5.52 in.

Free height after removing from machine, 36.21 in.



Test No. 14607.

Compressive test of Counter Recoil Spring, 3-inch Gun Carriage Model 1902. New Spring.

30446°—12——5

TEST 14569.

TENSILE TESTS OF CROSSHEAD PAWL SPRINGS, 10-IN. D. C., MODEL 1896.

Springs were tested by placing over pins $\frac{9}{16}$ in. diameter, by means of which the loads were applied.

The length was measured from outside to outside of pins by means of outside calipers. Measurements were made close to the spring.

A. Measurements on increasing loads.

B. Measurements on decreasing loads.

[Specifications for crosshead pawl springs, 10-in. D. C., model 1896 (drawing 9-10-28): The spring to be extended 0.8 in. 100 times and return to its original position; 105 lb. to extend spring not more than 0.33 in. (initial position); 262 lb. to extend spring not more than 0.83 in.]

Marks.		Free height.	At 105 lb.		At 262 lb.		Number of coils.	Diameter of wire.	Outside diameter of spring.
			Height.	Extension.	Height.	Extension.			
		In.	*In.*	*In.*	*In.*	*In.*		*In.*	*In.*
Spring No. 1, Battery Humphrey	A	7.40	7.83	0.43	8.50	1.10	13	0.191	1.01
	B	7.41	7.87	.47	8.52	1.12			
Spring No. 2, Battery Humphrey	A	7.32	7.55	.23	8.23	.91	13	.187	1.00
	B	7.32	7.54	.22	8.23	.91			
Spring No. 1, Battery Emory	A	7.41	7.50	.09	8.10	.69	11.5	.189	1.01
	B	7.41	7.51	.10	8.11	.70			
Tagged spring from store at Fort Washington	A	7.32	7.83	.51	8.56	1.24	13	.189	1.00
	B	7.33	7.84	.52	8.56	1.24			
Spring, not tagged, from store at Fort Washington	A	7.67	8.11	.44	8.73	1.06	12.5	.191	1.00
	B	7.67	8.12	.45	8.73	1.06			

TEST 14637.

COMPRESSION TEST OF STEEL HELICAL SPRING.

	Spring.	Specifications.
Free height ..... in..	6.40	6.25
Exterior diameter ..... in..	2.68	[1] 2.75
Size of wire ..... in..	.49	.....
Height at load of 810 lb ..... in..	5.72	.....
Load at height of 5½ in ..... lb..	1,058	810
Height at load of 1,890 lb ..... in..	4.77	.....
Height when solid ..... in..	4.56	[1] 4.5
Load when solid ..... lb..	2,280	.....
Height at load of 1,890 lb ..... in..	4.75	.....
Load at height of 5½ in ..... lb..	968	.....
Height at load of 810 lb ..... in..	5.64	.....
Free height ..... in..	6.37	.....

[1] Maximum.

TEST 14595.

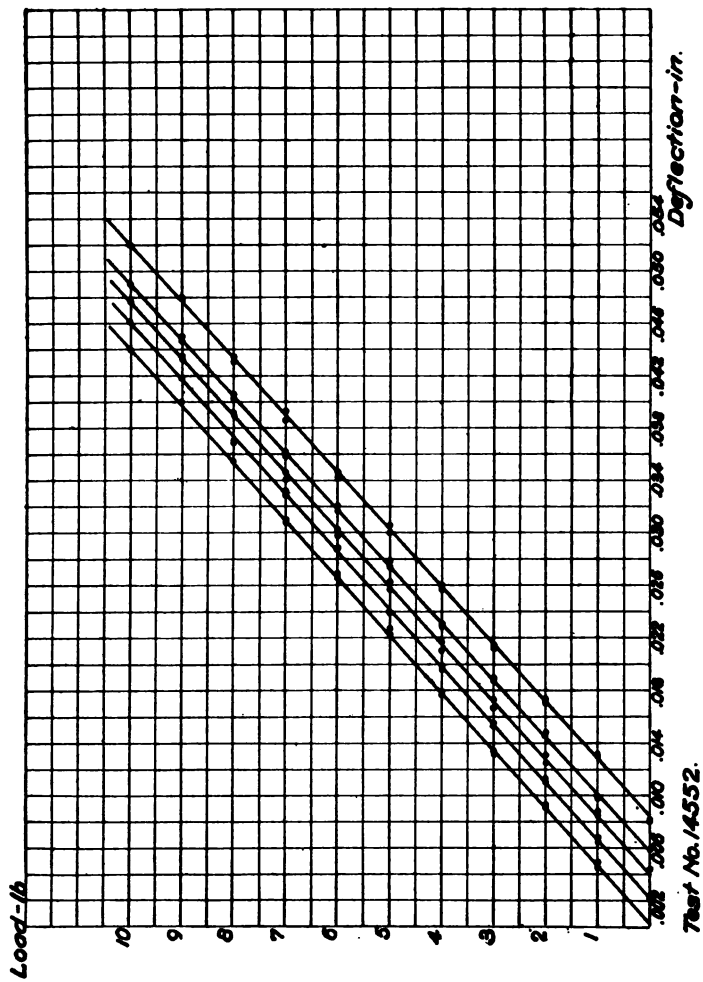
COMPRESSIVE TESTS OF TWO BUFFER SPRINGS FOR CARRIAGE OF 75 MM. MOUNTAIN GUN V. M. (DRAWING 2-14-9 REVISED SEPT. 26, 1910).

Dimensions of springs: Outside diameter, 2.2 in.; inside diameter, 1.1 in.; thickness of ribbon or wire, 0.10 in. (about).

Marks:

	A.	B.
Height when loaded with 105 lb ..... in..	22.73	22.29
Load at height of 21.10 in ..... lb..	125	119
Height when solid ..... in..	6.50	6.50
Load at solid height ..... lb..	322	304

Springs were jarred to relieve the friction on rod during the tests.



Test No. 14552.

Test of Spring Spring in cross-bending for Determination of the Modulus of Elasticity

TEST 14552.

DETERMINATION OF THE MODULUS OF ELASTICITY OF A STEEL SPRING (ORDNANCE SPONGE SPRING).

Span, when rollers against stops, 10 in. Spring placed on rollers when against stops, dial micrometer set at zero and deflections noted as loads were applied. As the spindle of the micrometer did not bear on spring at the center of its width, the spring was changed end for end, and readings from the two sides were averaged.

The same operations were repeated with the spring turned over so as to change the stress in the extreme fibers from tension to compression, and vice versa.

Spring, 0.117 in. thick by 1.260 in. wide.

Load at center.	Preliminary deflection.	Set.	Deflection.			
			Side A.		Side B.	
Lb.	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*
0	0.	.....	0.	0.	−.0001	0.
1	.0045	.....	.0045	.0045	.0038	.0050
2	.0091	.....	.0090	.0085	.0086	.0091
3	.0132	.....	.0133	.0127	.0128	.0132
4	.0177	0.	.0176	.0170	.0169	.0177
5	.0223	.....	.0219	.0217	.0214	.0220
6	.0265	.....	.0267	.0258	.0257	.0263
7	.0308	.....	.0309	.0301	.0299	.0307
8	.0355	.....	.0349	.0350	.0343	.0351
9	.0400	.....	.0398	.0393	.0387	.0399
10	.0440	.....	.0441	.0437	.0430	.0440
9	.0400	.....	.0398	.0395	.0390	.0400
8	.0356	.....	.0351	.0352	.0346	.0355
7	.0310	.....	.0312	.0307	.0302	.0313
6	.0269	.....	.0268	.0263	.0261	.0267
5	.0227	.0002	.0220	.0223	.0218	.0226
4	.0179	.....	.0178	.0177	.0170	.0180
3	.0134	.....	.0135	.0133	.0129	.0134
2	.0093	.....	.0093	.0091	.0088	.0093
1	.0049	.....	.0048	.0048	.0039	.0051
0	.0003	.....	.0002	.0004	−.0003	.0002

Deflection at load of 10 lb. from graph.

	In.
Preliminary	0.0438
A	.0439
A	.0437
B	.0432
B	.0437
Average	.0437

Modulus of elasticity, 28,000,000 lb. per sq. in.

PROOF TESTS OF PISTON RODS AND AXLES FOR ORDNANCE WORK.

TEST 14659.

PROOF STRESS APPLIED TO ONE 3.8-IN. PISTON ROD MARKED A2270.

SPECIFICATIONS.

Each piston rod when finished shall be held by the piston head and subjected to a pull, applied to the piston-rod nut, of 10,000 lb., without showing a permanent set. See special specifications governing the manufacture of 3.8-inch gun carriages, limbers, and caissons, model of 1904.

Load of 10,000 lb. applied to rod with the following results:

	Elongation (in.).
200 lb	0.
10,000 lb	.0120
200 lb	.0005

TEST 14591.

PROOF STRESS OF PISTON ROD FOR 6-IN. BARBETTE CARRIAGE.

Proof stress of 260, 988 lb. tension applied to rod without perceptible set.

DETAILS OF TEST.[1]

Gauged length, 20 in. on body of rod.
Diameter of rod, 3.75 in.
Sectional area, 11.04 sq. in.

Load.	Stress per sq. in.	Elongation.	
		In gauged length.	Per inch.
Lb.	*Lb.*	*In.*	*In.*
2,500	226	0.	0.
7,500	680	0.	0.
2,500	226	0.	0.
25,000	2,260	.0012	.00006
2,500	226	0.	0.
50,000	4,530	.0028	.00014
100,000	9,060	.0060	.00030
150,000	13,600	.0090	.00045
200,000	18,100	.0120	.00060
250,000	22,600	.0151	.000755
260,988	23,600	.0158	.00079
2,500	226	−.0002	−.00001

TEST 14647.

TRANSVERSE TEST OF A 3.8-INCH GUN-CARRIAGE AXLE FOR WATERTOWN ARSENAL, WATERTOWN, MASS.

Number at center of axle, 791.

Load at center.	Reading of dial micrometer.	Remarks.
Lb.		
200	0.	
2,000	.0178	
4,000	.0367	
6,000	.0558	
8,000	.0724	
10,000	.0899	
12,000	.1061	
14,000	.1237	
14,550	.1283	
14,000	.1238	
12,000	.1059	
10,000	.0868	
8,000	.0680	
6,000	.0484	
4,000	.0295	
2,000	.0117	
200	−.0059	
14,500	.....	
200	±.0001	
15,000	.....	
200	0.	

TEST 14650.

TRANSVERSE TESTS OF TWO 3.8-INCH CARRIAGE AXLES FOR WATERTOWN ARSENAL, WATERTOWN, MASS.

Axle Nos. 788 and 789.

Load of 14,550 lb. applied at middle of axle without any permanent set.

Comply with specifications.

TEST 14655.

TRANSVERSE TESTS OF THREE 3.8-INCH CARRIAGE AXLES FOR WATERTOWN ARSENAL, MASS.

Axles Nos. 792, 794, and 1189.

Load of 14,550 lb. applied at middle of axle with the following results: Axle No. 792, set 0.0005 in.; No. 794, set 0.0008 in.; No. 1189, set 0.0004 in.

HARDENED STEEL BALLS FOR 5-INCH NAVY MOUNTS.

COMPRESSIVE TESTS.

TEST 14636.

CRUSHING TESTS OF HARDENED STEEL BALLS FOR 5-INCH NAVY MOUNTS.

SPECIFICATIONS.

Balls to be made of high grade tool steel and hardened so that they can not be marked with a new file. Each ball shall be perfectly spherical and be of the diameter specified with a plus or minus tolerance of not more than $\frac{1}{10000}$ inch. When tested between hardened steel plates must show a resistance to crushing equal to $1{,}300d^2$ lb., where "d" equals the number of $\frac{1}{8}$ in. in the specified diameter.

CRUSHING TESTS.

Size of ball.	Crushing strength.	Size of ball.	Crushing strength.	Size of ball.	Crushing strength.
In.	*Lb.*	*In.*	*Lb.*	*In.*	*Lb.*
1	3,400	1	9,884	1	39,739
1	1,550	1	14,790	1	46,594
1	2,366	1	12,668	1	42,544
1	1,549	1	11,873	1	44,013
1	3,413	1	14,984	1	53,142

Appearance of fractures, fine granular.

14-INCH GUN TURRET, MODEL 1909.

TENSILE TESTS OF CAST IRON FROM THIRD BASE RING CASTING.

TEST 14599.

TENSILE TESTS OF CAST-IRON SPECIMENS FROM THIRD BASE RING CASTING FOR 14-INCH GUN TURRET, MODEL 1909.

Marks.	Diameter.	Sectional area.	Tensile load.	Strength stress per sq. in.
	In.	*Sq. in.*	*Lb.*	*Lb.*
3-1-3	1.13	1.00	24,700	24,700
3-2-3	1.13	1.00	24,000	24,000
3-3-3	1.13	1.00	24,400	24,400
3-4-3	1.13	1.00	25,800	25,800
3-5-3	1.13	1.00	26,600	26,600
3-6-3	1.13	1.00	29,200	29,200

Appearance of fracture, medium granular.

STEEL CASTINGS FOR ORDNANCE WORK.

CAST STEEL FROM WATERTOWN ARSENAL STEEL PLANT.

[The inch in which fracture occurred is marked thus *.]

Heat number.	Grade.	Chemical composition.					Elastic limit per sq. in.	Tensile strength per sq. in.	Elongation.	Contraction of area.	Elongation of inch sections.		Sclero-scope hardness.	Appearance of fracture.
		Carbon.	Manganese.	Silicon.	Sulphur.	Phosphorus.								
		Per cent.	*Per cent.*	*Per ct.*	*Per ct.*	*Per ct.*	*Lb.*	*Lb.*	*Per cent.*	*Per cent.*	*In.*	*In.*		
2430	2	0.45	0.91	.....	.....	.....	47,500	90,000	15.5	20.5	0.17*	0.14	.....	Gray amorphous, 33 per cent; fine granular, 67 per cent.
2431	2	.56	.78	.....	.....	.....	61,200	111,700	7.0	5.7	.08*	.06	.....	Gray amorphous, 10 per cent; fine granular, 90 per cent.
2432	2	.45	.80	.....	.....	.....	43,500	99,000	17.5	16.9	.18*	.17	.....	Fine granular.
							38,500	77,000	25.5	34.0	.25*	.26*	.....	Dull silky.
2433	2	.46	.73	.....	.....	.....	50,000	93,000	11.5	13.7	.11	.12*	.....	Fine granular, 80 per cent; amorphous 20 per cent.
2434	2	.36	.81	.....	.....	.....	51,000	84,700	21.5	23.9	.22*	.21*	.....	Gray amorphous, 25 per cent; fine granular, 75 per cent.
2435	2	.39	.86	.....	.....	.....	50,000	87,000	15.5	20.5	.14	.17*	.....	Gray amorphous.
2436	2	.32	.95	.....	.....	.....								
2438	2	.48	.88	.....	.....	.....	48,000	85,500	15.5	20.5	.13	.18*	.....	Silky.
2439	2	.39	.89	.....	.....	.....								
2440	2	.38	.78	.....	.....	.....	40,500	77,500	20.5	27.4	.21*	.20	.....	Gray amorphous.
2441	2	.29	.84	.....	.....	.....								
2442	2	.28	.87	.....	.....	.....	48,000	85,000	13.5	20.5	.16*	.11	.....	Do.
2443	2	.33	.82	.....	.....	.....								
2444	2	.....	.....	.....	.....	.....	36,500	69,000	27.5	36.5	.23	.32*	.....	Do.
2445	2	.....	.....	.....	.....	.....	39,300	63,200	18.0	30.7	.21*	.14	.....	Do.
							73,500	85,000	25.0	43.3	.18	.32*	.....	Do.
							34,500	76,500	27.0	37.1	.21	.33*	.....	Do.
2446	2	.35	.87	.....	.....	.....	41,800	83,600	16.5	54.6	.14	.19*	.....	Do.
2447	2	.34	1.01	.....	.....	.....	46,500	84,500	16.5	23.9	.18*	.15	.....	Do.
2448	2	.33	.92	.....	.....	.....								
2449	2	.33	1.07	.....	.....	.....	53,000	84,150	18.0	27.4	.15	.21*	.....	Do.
2450	2	.32	1.00	.....	.....	.....								
2451	2	.33	.84	.....	.....	.....	45,200	79,000	17.0	23.6	.15	.19*	.....	Do.
2452	2	.29	.88	.....	.....	.....								
2453	2	.37	.90	.....	.....	.....	37,000	76,500	27.5	40.3	.22	.33*	.....	Do.
2454	2	.35	1.11	.....	.....	.....								
2455	3	.41	1.07	.....	.....	.....	47,500	88,000	18.0	20.5	.17	.19*	.....	Do.
2456	2	.35	.94	.....	.....	.....	39,500	78,000	15.5	23.9	.18*	.13	.....	Do.
2457	2	.29	.72	.....	.....	.....								
2458	2	.36	1.00	.....	.....	.....	44,000	80,500	20.0	30.7	.24*	.16	.....	Do.
2459	2	.30	.97	.....	.....	.....								
2460	2	.30	1.03	.....	.....	.....	47,500	81,500	21.0	27.4	.18	.24*	.....	Silky.
2461	2	.32	.96	.....	.....	.....								

2462	2	.32	.85				39,400	78,800	15.0	23.2	.17*, .12		Gray amorphous, 90 per cent; small crystal, fine granular, 10 per cent.
2463	2	.34	1.00										
2464	2	.30	1.05				41,500	78,000	24.0	30.7	.20, .28*		Gray amorphous.
2465	2	.30	1.12										
2466	2	.32	.97				35,700	75,000	24.5	37.1	.31*, .18		Silky.
2467	2	.31	1.15										
2468	2	.30	1.02				51,000	87,000	11.0	13.2	.12*, .10		Gray amorphous, 60 per cent; fine granular, 40 per cent.
2469	3	.31	.99				45,000	81,000	19.0	20.5	.21*, .17		Fine granular.
2470	2	.35	1.08				48,000	86,000	20.5	27.4	.23*, .18		Gray amorphous.
2471	2	.30	1.03										
2472	2	.31	.94				45,000	83,500	14.5	23.9	.16*, .13		Silky.
2473	2	.31	.96				46,500	84,500	17.0	24.0	.20*, .14		Do.
							40,500	74,000	28.0	49.1	.36*, .20		Gray amorphous.
2474	2	.30	.96				37,700	73,400	24.5	27.4	.25, .24		Do.
							40,000	73,500	20.0	27.4	.22*, .18		Do.
							35,000	76,000	25.5	34.0	.23*, .28*		Silky.
2475	2						48,500	91,000	12.5	13.2	.14*, .11		Gray amorphous, 25 per cent; fine granular, 75 per cent.
2476	2	.44	1.06				44,500	82,000	24.5	34.0	.28*, .21		Fine granular.
	2												
2478	2	.33	1.08				45,000	85,500	17.5	23.9	.17, .18*		Gray amorphous.
	2												
2480	2	.36	.74				44,000	82,000	19.5	34.0	.21*, .18		Dull silky.
2481													
2482	2	.34	1.11										
2483													
2484		.38	.91	0.282	[1] 3.14	0.041	48,500	96,500	21.5	34.0	.16, .27*		Do.
							53,500	87,000	12.0	16.9	.13*, .11		Gray amorphous.
2485	2,3	.39	1.11				63,000	100,000	11.5	13.2	.10, .13*		Gray amorphous, 60 per cent; fine granular, 40 per cent.
							48,400	80,600	16.5	27.4	.13, .20*		Gray amorphous.
							39,000	74,000	29.5	37.1	.35*, .24		Do.
2486	2	.30	1.07				45,000	80,500	21.5	30.7	.25*, .18		Silky.
2487	2	.36	1.12				46,500	85,000	23.0	30.7	.22, .24*		Gray amorphous.
2488	2	.30	1.04										
2489	2	.35	.86				41,500	81,000	14.0	20.5	.18*, .10		Silky.
							42,500	81,000	14.0	24.0	.17*, .11		Do.
2490	2	.31	1.02				62,000	100,500	22.0	37.1	.22*, .22*		Dull silky.
2491	2	.33	1.03				45,500	85,000	14.5	20.5	.12, .17*		Silky.
2492	2	.33	1.01				47,000	88,000	14.0	24.0	.11, .17*		Gray amorphous.
2493	2	.41	1.09				37,000	76,000	27.5	34.0	.32*, .23		Silky.
2494	2	.29	1.03										
2495	2	.32	1.06				46,500	77,500	29.0	43.3	.27*, .31*		Gray amorphous.
2496	2	.30	.86				42,500	70,000	30.0	51.9	.40*, .20		Silky.
							46,000	86,000	23.5	30.7	.28*, .19		Do.
2497	2	.36	.89				46,000	79,500	15.0	24.0	.18*, .12		Do.
2498	2	.30	.80										
2499	2	.30	.74				43,500	81,000	16.5	20.5	.19*, .14		Dull silky.
2500	2	.33	.78										
2501	2	.31	.78				42,500	79,000	20.0	27.4	.17, .23*		Do.
2502	2	.30	.75										
2503	2,3	.40	.92				52,000	91,300	12.5	16.9	.11, .14*		Gray amorphous, 20 per cent; fine granular, 80 per cent.
							47,500	84,500	24.0	27.4	.28*, .20		Gray amorphous.

[1] Nickel.

Cast steel from Watertown Arsenal steel plant—Continued.

Heat number.	Grade.	Chemical composition.					Elastic limit per sq. in.	Tensile strength per sq. in.	Elongation.	Contraction of area.	Elongation of inch sections.		Sclero-scope hard-ness.	Appearance of fracture.
		Carbon.	Manga-nese.	Sili-con.	Sul-phur.	Phos-phorus.								
		Per cent.	*Per cent.*	*Per ct.*	*Per ct.*	*Per ct.*	*Lb.*	*Lb.*	*Per cent.*	*Per cent.*	*In.*	*In.*		
2504	2,3	0.33	0.78	0.179	0.047	0.045	35,000	71,500	21.0	27.4	.18,	.24*	.....	Silky oblique.
							46,000	78,500	23.5	30.7	.22,	.25*	.....	Dull silky.
							52,000	90,300	14.0	22.5	.17*,	.11	.....	Gray amorphous.
2505	2,3	.36	.80	.265	.045	.049	40,500	78,000	19.5	24.0	.23*,	.16	.....	Dull silky.
2506	2,3	.35	.83	.312	.045	.047								
2507	2,3	.30	.74	.192	.046	.043	45,500	82,500	15.0	24.0	.13,	.17*	.....	Silky.
2508	2,3	.32	.95	.237	.040	.046	51,500	85,000	17.5	27.4	.19*,	.16	.....	Do.
2509	2	.31	.76	.179	.049	.052	40,000	74,000	26.5	30.7	.32*,	.21	.....	Gray amorphous.
2510	2	.34	.86	.214	.043	.056	45,500	75,500	27.0	34.0	.28*,	.26	.....	Silky.
2511	2,3	.34	.79	.225	.048	.040	44,000	81,000	15.5	20.5	.19*,	.12	.....	Gray amorphous.
2512	2,3	.34	.94	.308	.041	.044	55,000	78,000	23.0	34.0	.31*,	.15	.....	Silky.
							65,500	102,000	11.5	16.9	.14*,	.09	.....	Fine granular, 85 per cent; silky, 15 per cent.
2513	2	.33	.84	.....	.....	.0449	46,500	80,500	16.5	24.0	.20*,	.13	.....	Dull silky.
2514														
2515	2,3	.34	.97	.....	.....	.040	35,500	73,000	29.0	43.3	.20,	.38*	.....	Silky.
2516	2,3	.30	.86	.....	.....	.051	56,500	89,500	21.5	40.3	.17,	.26*	.....	Do.
							50,500	83,000	27.0	46.2	.23,	.31*	.....	Do.
2517	2	.28	.79	.....	.023	.046	56,000	89,000	21.5	40.3	.17,	.26*	.....	Do.
2518	2	.29	.75	.179	.038	.040	52,500	80,000	25.0	43.3	.33*,	.17	.....	Do.
2519	2,3	.30	.83	.....	.040	.044	39,500	76,500	23.0	34.0	.28*,	.18	.....	Do.
2520	.....	.....	.....	.....	.....	.....	58,100	91,800	17.0	37.1	.....	.....	.....	
2521	.....	.37	1.06	.202	.036	.045	.....	.....	.....	.....	.....	.....	.....	
2522	2	.33	.84	.237	.042	.056	45,500	81,000	26.5	37.1	.20,	.33*	.....	Dull silky.
2523	2	.34	.98	.....	.038	.045								
2524	2	.37	.84	.....	.034	.042	40,000	80,000	22.0	24.0	.26*,	.18	.....	Silky.
2525	2	.40	1.00	.337	.036	.049								
2526	2	.39	.84	.315	.037	.048	44,000	82,000	28.0	43.3	.34*,	.22	.....	Dull silky.
2527	2	.30	.76	.332	.040	.044								
2528	2	.30	.74	.295	.040	.044	52,500	82,000	19.5	24.0	.17,	.22*	.....	Do.
2529	2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
2530	2	.31	1.07	.256	.038	.044	35,000	75,000	28.5	43.3	.25,	.32*	.....	Do.
2531	2,3	.29	.82	.249	.035	.042	51,500	78,500	26.5	40.3	.22,	.31*	.....	Do.
2532	2	.29	.83	.286	.031	.040								
2533	2,3	.31	.79	.226	.029	.045	40,500	83,500	22.5	34.0	.17,	.28*	.....	Silky.
2534	2,3	.30	.88	.300	.036	.037	59,000	91,500	19.0	30.7	.15,	.23*	.....	Amorphous.
2535	2	.30	.72	.235	.034	.040	39,800	79,000	25.5	37.1	.28*,	.23	.....	Silky.
2536	2	.31	.78	.321	.037	.043								

2537	2	.32	.88	.272	.038	.043	39,500	76,500	22.0	40.3	.29*, .15	.....	Dull silky.
2538	2	.29	.77	.260	.028	.032							
2539	.....	.35	.84	.268	.030	.044	46,500	88,500	23.5	34.0	.30*, .17	.....	Do.
2540	.....	.35	1.04	.312	.034	.048							
2541	2	.34	.90	.276	.038	.044	55,000	83,500	23.5	40.3	.31*, .16	.....	Silky.
2542	2	.32	.98	.312	.038	.049							
2543	2	.32	.92	.252	.039	.049	40,000	79,000	27.5	40.3	.23, .32*	.....	Do.
2544	2	.34	1.01	.263	.036	.048							
2545	2	.34	.91	.310	.038	.045	46,400	81,000	19.0	30.7	.18*, .20*	.....	Do.
2546	2	.34	1.03	.320	.036	.048							
2547	2	.32	.86	.300	.037	.048	48,000	84,500	25.0	40.3	.33*, .17	.....	Do.
2548	2	.33	.99	.271	.035	.049							
							63,500	81,000	19.0	24.0	.22*, .16	.....	Dull silky.
2549	3	.39	.98	.273	.037	.047	43,000	80,500	14.5	24.0	.11, .18*	.....	Do.
							62,500	95,500	19.0	37.1	.26*, .12	.....	Silky.
2550	2	.35	.97	.305	.....	.047	39,000	77,500	27.0	40.3	.20, .34*	.....	Do.
2551	2	.40	.86	.291	.040	.048	52,500	82,000	26.5	40.3	.31*, .22	.....	Do.
2552	2	.39	.98	.348	.038	.048							
2553	2	.29	.92	.225	.034	.047	49,000	91,500	15.0	16.9	.12, .18*	.....	Gray amorphous, 50 per cent; fine granular, 50 per cent.
2554	2	.35	.88	.252	.037	.049	43,500	80,000	16.5	27.4	.15, .18*	.....	Silky.
2555	1	.35	1.01	.305	.034	.042	43,000	77,500	26.0	34.0	.28*, .24	.....	Dull silky
2556	1	.33	.89	.275	.036	.045							
2557	1	.36	.92	.282	.035	.044	.....	.....	.....	.....	.....	.....	
2558	2	.34	.93	.300	.037	.044	42,500	83,500	23.0	37.1	.17, .29*	.....	Silky.
2559	2	.30	.92	.296	.038	.039							
2560	2	.33	1.10	.249	.033	.049	40,500	78,000	30.5	40.3	.35*, .26	.....	Do.
2561	2	.35	.89	.268	.041	.053	43,500	83,000	18.5	20.5	.25*, .12	.....	Do.
2562	2	.33	.96	.282	.039	.045							
2563	2	.36	.90	.227	.036	.047	42,500	80,000	18.5	27.4	.22*, .15	.....	Do.
2564	2	.32	.94	.286	.038	.048							
2565	1,2	.32	.88	.243	.046	.046	44,000	81,000	24.5	27.4	.27*, .22	.....	Do.
2566	1,2	.37	.89	.286	.039	.047							
2567	2	.39	1.03	.237	.040	.036	45,000	81,500	17.5	24.0	.15, .20*	.....	Gray amorphous.
2568	2	.40	.96	.307	.036	.058	40,000	79,000	16.0	20.5	.14, .18*	.....	Do.
2569	2	.38	.95	.254	.042	.047							
2570	2	.34	.89	.....	.040	.....	40,000	76,000	26.5	37.1	.19, .34*	.....	Silky.
2571	2	.36	.80	.....	.042	.....	40,000	79,500	15.5	20.5	.19* .12	.....	Do.
2572	2	.35	.90	.....	.039	.....							
2573	2	.38	.78	.....	.042	.....	34,000	76,000	25.5	37.1	.30*, .21	.....	Do.
2574	2	.....	.92	.....	.....	.....							
2575	2	.37	.83	.....	.034	.....	48,500	96,000	12.5	13.2	.14*, .11	.....	Granular, with silky spot at circumference.
2576	2	.30	.80	.....	.....	.....	39,500	81,000	19.5	27.4	.17, .22*	.....	Silky.
2577	2	.37	.85	.....	.049	.....	40,500	81,000	18.5	24.0	.20*, .17	.....	Gray amorphous.
2578	2	.31	.77	.....	.054	.....							
							37,000	74,500	20.5	27.4	.22*, .19	.....	Do.
							48,500	88,500	12.5	16.9	.15*, .10	.....	Fine granular.
2579	2,3	.34	.88	.....	.....	.....	48,000	87,000	13.0	20.5	.12, .14*	.....	Fine granular, 40 per cent; amorphous, 60 per cent.
							36,500	76,500	29.5	43.3	.23, .36*	.....	Silky.
2580	2	.32	.86	.....	.....	.....	38,500	75,000	30.5	46.2	.33*, .28	.....	Do.
2581	1,2	.37	.91	.....	.....	.....	42,500	83,000	16.5	20.5	.20*, .13	.....	Do.
2582	2	.31	1.16	.....	.....	.....	45,000	83,000	20.0	27.4	.19, .21*	.....	Do.

Cast steel from Watertown Arsenal steel plant—Continued.

Heat number.	Grade.	Chemical composition.					Elastic limit per sq. in.	Tensile strength per sq. in.	Elongation.	Contraction of area.	Elongation of inch sections.	Scleroscope hardness.	Appearance of fracture.
		Carbon.	Manganese.	Silicon.	Sulphur.	Phosphorus.							
		Per cent.	*Per cent.*	*Per ct.*	*Per ct.*	*Per ct.*	*Lb.*	*Lb.*	*Per cent.*	*Per cent.*	*In.* *In.*		
2583	2	0.34	0.95				39,500	79,500	27.0	40.3	0.22, 0.32*	.....	Silky.
2584	2	.31	.96										
2585	2,3	.29	.94	.....	.....	.....	42,500	76,000	27.5	37.1	.29*, .26	.....	Do.
							59,500	90,000	21.0	37.1	.14, .28*	.....	Do.
2586	2	.32	.88				35,500	74,000	26.5	37.1	.35*, .18	.....	Do.
2587	2	.28	.78	.....	.....	.....							
2588	2	.38	.98	.....	.....	.....	42,000	87,000	21.0	27.4	.19, .23*	.....	Do.
2589	2	.32	.83				48,000	79,500	20.0	30.7	.16, .24*	.....	Do.
2590	2	.34	.92	.....	.....	.....							
2591	2	.32	.86				41,500	80,500	25.5	40.3	.31*, .20	.....	Do.
2592	2	.34	1.04	.....	.....	.....							
2593	2	.36	.90				40,000	83,000	23.0	34.0	.29*, .17	.....	Do.
2594	2	.32	.96	.....	.....	.....							
2595	2	.37	1.00				41,000	84,500	19.0	27.4	.18, .20*	.....	Do.
2596	2	.36	1.04	.....	.....	.....							
2598	.....	.36	1.11	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
2599	2	.35	1.07				46,000	86,000	18.0	20.5	.21*, .15	.....	Do.
2600	2	.32	1.06	.....	.....	.....							
2601	2	.36	.90				41,500	80,500	23.5	30.7	.20, .27*	.....	Do.
2602	2	.32	1.16	.....	.....	.....							
2603	2	.35	.89				45,500	83,500	17.0	24.0	.15, .19*	.....	Silky, with granular spots near circumference.
2604	2	.37	1.09	.....	.....	.....							
2605	2	.37	1.08				40,500	81,500	25.0	30.7	.30*, .20	.....	Silky.
2606	2	.37	1.03	.....	.....	.....							
2607	2	.38	.72	.....	.....	.....	41,500	82,000	26.5	37.1	.29*, .24	.....	Do.
2608	2	.39	.98				46,500	88,500	21.5	30.7	.25*, .18	.....	Do.
2609	2	.38	1.09	.....	.....	.....							
2610	2	.37	1.00				50,500	91,500	22.0	34.0	.16, .28*	.....	Do
2611	2	.38	.89	.....	.....	.....							
2612	2	.35	1.04				42,000	85,000	22.5	30.7	.18, .27*	.....	Do.
2613	2	.37	1.06	.....	.....	.....							
2614	2	.38	.81				48,500	84,000	23.5	30.7	.20, .27*	.....	Do.
2615	2	.....	.....	.....	.....	.....							
2616	2	.40	.93	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
2617	2	.38	1.02	.....	.....	.....	39,500	81,500	23.5	34.0	.28*, .19	.....	Do.
2618	1	.36	.79				48,500	85,500	25.5	30.7	.31*, .20	.....	Do.
2619	1	.36	.97	.....	.....	.....							

2620	2	.33	.96				42,500	85,000	23.0	37.1	.29*, .17		Do.
2621	2	.32	.80										
2622	2	.37	.87				45,500	83,500	20.0	24.0	.18, .22*		Silky, granular spots at circumference.
2623	2	.34	.88										
2624	.....	.40	.74				49,500	86,000	15.5	20.5	.14, .17*		Silky.
2625	1,2	.40	.72				37,500	75,500	24.5	43.3	.35*, .14		Fine granular, 50 per cent; amorphous, 50 per cent.
2626	1,2	.34	.91				51,000	93,000	15.0	16.9	.17*, .13		Silky.
2627	2	.46	.73				49,000	88,500	19.5	30.7	.14*, .25*		
2628	2	.40	.61										
2629	2	.36	.61				48,500	86,000	12.5	13.2	.13*, .12		Granular, silky spot at circumference.
2630	2	.26	.64				44,000	79,500	26.0	34.0	.27*, .25	25.0	Dull silky; trace of granulation.
2631	2	.32	.62				36,500	74,500	25.5	34.0	.30*, .21		Silky.
2632	2	.26	.69				43,000	76,500	23.0	27.4	.21, .25*		Do.
2633	2	.40	90				39,500	79,500	27.0	37.1	.32*, .22		Do.
2634	2	.37	.92										
2635	2	.38	.87				45,000	83,500	18.5	20.5	.21*, .16		Silky, 60 per cent; granular, 40 per cent.
2636	2	.27	.69				49,000	85,000	11.5	16.9	.10, .13*		Silky.
2637	2	.28	.66				42,000	77,000	19.0	27.4	.17, .21*		Amorphous.
2638	2,3	.42	.85				46,000	89,500	14.0	16.9	.13, .15*		Fine granular.
							60,000	86,000	22.0	30.7	.23*, .21		Do.
2639	2	.41	.88				47,500	85,000	13.0	13 2	.12, .14*		Fine granular, 90 per cent; silky, 10 per cent.
							45,500	83,500	14.0	13.2	.17*, .11		Silky.
2640	2	.43	.95				35,000	71,500	26.0	24.0	.27*, .25		Amorphous.
							45,000	83,000	12.0	20.5	.10, .14*		Do.
							43,500	80,000	26.5	37.1	.27*, .26*	25.0	Dull silky.
2641	2	.41	.76				45,500	85,000	17.5	27.4	.20*, .15		Silky.
2642	2	.33	.72										
2643	2	.35	.77				44,000	82,500	17.0	24.0	.15, .19*		
2644	2	.30	.83										
2645	2	.35	.78				40,000	79,500	23.0	27.4	.27*, .19		Do.
2646	2	.38	.85										
2647	3	.42	.85		[1] 3.28		60,500	96,500	21.0	30.7	.17, .25*		Fine granular
2648	2	.38	.81				36,500	74,000	24.5	30.7	.28*, .21		Silky.
2649	2	.39	.81				45,500	79,000	24.5	30.7	.23, .26*		Amorphous.
							34,500	69,000	30.0	43.3	.39*, .21		Silky.
2650	2	.31	.78				43,000	73,500	29.5	46.2	.38*, .21		Do.
							49,500	79,000	18.0	24.0	.15*, .11		Amorphous, 95 per cent; granular, 5 per cent.
							51,000	82,000	23.0	30.7	.22, .24*	25.0	Silky.
2651	2	.31	.74				45,000	80,500	21.0	27.4	.24*, .18		Do.
2652	2	.31	.84										
2653	2	.38	.75				42,000	80,000	21.0	27.4	.26*, .16		Do.
2654	2	.33	.77										
2655	2	.32	.92				38,500	72,000	31.5	43.3	.26, .37*		Silky; cup shaped.
							44,500	72,500	29.5	49.1	.20, .39*		Silky.
							57,000	92,500	23.5	34.0	.21, .26*		Do.
2656	3	.33	.78				72,000	110,000	12.5	9.5	.10, .15*		Amorphous, 50 per cent; granular, 50 per cent.
2657	2	.33	.92				43,500	82,000	19.0	24.0	.22*, .16		Silky, with granular spots near circumference.
2658	2	.33	.96										
2659	2	.31	.79				40,500	81,000	21.0	27.4	.20, .22*	28.0	Silky.
2660	2	.32	.79										

[1] Nickel.

Cast steel from Watertown Arsenal steel plant—Continued.

Heat number.	Grade.	Chemical composition.					Elastic limit per sq. in.	Tensile strength per sq. in.	Elongation.	Contraction of area.	Elongation of inch sections.		Sclero-scope hard-ness.	Appearance of fracture.
		Carbon.	Manga-nese.	Sili-con.	Sul-phur.	Phos-phorus.								
		Per cent.	*Per cent.*	*Per ct.*	*Per ct.*	*Per ct.*	*Lb.*	*Lb.*	*Per cent.*	*Per cent.*	*In.*	*In.*		
2661	2	0.46	0.78	.....	.....	.....	42,500	80,500	21.0	30.7	0.28*	0.14	.....	Silky.
2662	2	.39	.84	.....	.....	.....	42,000	80,500	17.0	20.5	.19*	.15	.....	Amorphous.
2663	2	.38	.83	.....	.....	.....	41,500	82,500	18.0	24.0	.20*	.16*	.....	Silky.
2664	.....	.38	.92	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
2665	2	.40	.87	.....	.....	.....	44,000	84,500	14.0	24.0	.17*	.11	.....	Silky, 75 per cent; granular, 25 per cent.
2666	2	.36	.90	.....	.....	.....	43,500	85,500	13.5	13.2	.13*	.14	.....	Granular, silky spot at circumference.
							45,000	76,500	20.0	27.4	.24*	.16	24.0	Amorphous.
2667	2	.37	.81	.....	.....	.....	46,500	88,500	19.5	20.5	.20,	.19*	.....	Amorphous, 30 per cent; fine granular, 70 per cent.
2668	2	.36	.82											
2669	2	.35	.77	.....	.....	.....	48,500	85,000	12.5	16.9	.14*	.11	.....	Silky.
2670	2	.36	.88	.....	.....	.....	42,000	76,000	25.0	40.3	.18,	.32*	25.0	Do.
2671	2	.36	.90	.....	.....	.....	49,500	86,500	18.0	20.5	.17,	.19*	.....	Granular, 40 per cent; silky, 60 per cent.
2672	2	.35	.83	.....	.....	.....	39,500	80,500	21.5	27.4	.25*	.18	.....	Silky with a granular spot near circumference.
2673	2	.38	.91											
2674	2	.39	.93	.....	.....	.....	43,500	80,000	15.0	16.9	.13,	.17*	.....	Amorphous.
2675	2	.37	.88	.....	.....	.....	43,500	80,000	20.0	24.0	.23*	.17	.....	Silky.
2676	2	.34	.79	.....	.....	.....	38,500	75,000	24.5	30.7	.26*	.23*	.....	Do.
2677	2	.33	.94											
2678	2	.35	.79	.....	.....	.....	40,500	78,000	21.0	30.7	.25*	.17	.....	Silky, 95 per cent; granular, 5 per cent.
2679	2	.35	.85											
2680	2	.36	.93	.....	.....	.....	41,000	75,000	28.0	37.1	.32*	.24	.....	Silky.
2681	2	.35	.88	.....	.....	.....	44,500	80,500	17.0	20.5	.20*	.14	.....	Do.
2682	2	.36	.95											
2683	.....	.38	.93	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
2684	2	.36	.93	.....	.....	.....	44,000	81,000	21.0	24.0	.19,	.23*	.....	Silky.
2685	2	.37	.94	.....	.....	.....	44,000	82,500	17.0	24.0	.15,	.19*	.....	Silky, with granular spots.
2686	2	.36	1.00											
2687	2	.35	.85	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
2688	2	.35	.90	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
2689	2	.36	.86	.....	.....	.....	40,000	77,000	29.0	46.2	.36*	.22	.....	Silky.
2690	2	.35	.88											
2691	2	.35	.88	.....	.....	.....	44,500	82,000	19.5	24.0	.23*	.16	.....	Do.
2692	2	.34	.94											
2693	2	.35	.83	.....	.....	.....	43,000	81,000	25.0	37.1	.21,	.29*	24.0	Do.
2694	2	.34	.95											
2695	2,3	.32	.89	.....	.....	.....	39,500	78,500	25.0	30.7	.24,	.26*	.....	Do.
2696	2,3	.31	.79	.....	.....	.....	64,500	94,500	22.5	34.0	.29*	.16	.....	Do.

2697	2	.35	1.06				43,500	79,000	23.5	27.4	.19, .28*		Do.
2698	2	.31	.87										
2699	2	.33	.82				36,500	74,500	24.5	30.7	.22, 27*		Do.
2700	2	.30	.89										
2701		.34	.90										
2702	2	.35	.80				39,000	76,500	22.5	27.4	.28*, .17		Do.
2703	2	.32	.86										
2704	2	.30	.72				40,500	80,000	23.0	27.4	.26*, .20		Do.
2705	2	.35	.80										
2706	2	.35	.90				36,500	75,500	24.0	30.7	.27*, .21		Do.
2707													
2708	2	.31	.90				41,000	78,000	28.0	40.3	.22, .34*		Do.
2709	2	.30	.88				40,000	72,500	26.0	43.3	.15, .37*		Do.
2710	2						41,500	78,000	26.5	37.1	.33*, .20		Do.
2711	2	.32	.85				54,500	101,500	6.0	5.7	.07*, .05		Granular, silky spot at circumference.
2712	2	.31	.90				48,500	81,500	23.5	27.4	.21, .26*	25.0	Silky.
2713	2	.33	.88				39,500	75,500	21.5	27.4	.26*, .17		Do.
2714	2	.35	.91										
2715	2	.34	.94				39,000	72,000	25.0	34.0	.26*, .24*		Do.
							40,500	73,500	23.0	34.0	.18, .28*		Amorphous.
2716	2	.34	.80				40,000	70,500	15.5	27.4	.11, .20*	24.0	Silky, with dark spot at circumference.
							41,500	79,500	27.5	43.3	.23, .32*	25.0	Silky.
2717	2	.32	.80				33,000	68,500	24.5	27.4	.22, .27*		Amorphous.
							34,000	69,500	24.5	30.7	.29*, .20	24.0	Silky.
2718	2	.35	.84				37,000	71,000	29.0	34.0	.34*, .24	24.0	Do.
							44,000	75,000	28.0	46.2	.21, .35*	23.0	Do.
							35,000	73,000	27.5	40.3	.20, .35*		Do.
2719	2	.32	.80				40,500	78,500	18.5	24.0	.24*, .13		Amorphous.
2720	2	.36	.82				37,500	71,500	28.0	37.1	.32*, .24		Silky.
2721	2	.34	.86				44,500	76,500	21.5	24.0	.18, .25*		Amorphous.
2722	2	.32	.93				43,000	75,500	18.5	20.5	.20*, .17		Amorphous.
2723	2	.33	.85										
2724	2	.31	.75				41,500	74,000	22.5	27.4	.20, .25*	24.0	Dull silky.
							46,800	85,600	13.0	33.0	.15*, .11	26.0	Do.
2725	2	.32	.82				48,500	84,000	12.0	16.9	.14*, .10	27.0	Amorphous.
							56,500	87,000	23.0	34.0	.20, .26*	26.0	Silky.
2726	2	.31	.77				50,000	82,500	23.0	27.4	.22, .24*	25.0	Dull silky.
2727	2	.33	.78										
2728	2	.34	.77				35,000	74,500	31.0	40.3	.34*, .28*		Silky.
2729	2	.33	.90										
2730	2	.36	.88				43,000	79,500	20.5	27.4	.24*, .17		Amorphous.
2731	2	.35	.84										
2732	2	.35	.77				38,000	74,000	18.5	24.0	.16, .21*	23.0	Do.
2733	2	.34	.77				40,000	75,500	27.0	37.1	.30*, .24	25.0	Silky.
2734	2	.32	.96				44,000	83,000	18.0	20.5	.20*, .16		Fine granular.
2735	2	.32	.84				44,000	83,500	22.0	27.4	.27*, .17	25.0	Dull silky
2736	2	.32	1.03										
2737	2	.34	.96				44,500	82,000	15.0	24.0	.16*, .14	24.0	Amorphous.
2738	2	.34	.96										
2739	2	.34	.96				43,000	81,000	20.0	24.0	.23*, .17		Silky.
2740	2	.33	.97										
2741	2	.33	.85				35,500	73,500	30.5	43.3	.38*, .23		Do.
							42,300	78,600	25.5	36.2	.33*, .18		Do.

Cast steel from Watertown Arsenal steel plant—Continued.

Heat number.	Grade.	Chemical composition.					Elastic limit per sq. in.	Tensile strength per sq. in.	Elongation.	Contraction of area.	Elongation of inch sections.	Sclero-scope hardness.	Appearance of fracture.
		Carbon.	Manganese.	Silicon.	Sulphur.	Phosphorus.							
		Per cent.	*Per cent.*	*Per ct.*	*Per ct.*	*Per ct.*	*Lb.*	*Lb.*	*Per cent.*	*Per cent.*	*In.* *In.*		
2742	2	.34	.88				44,000	83,000	15.0	20.5	0.17*, 0.13		Amorphous.
2743	2	.32	.98										
2744	2	.38	.97										
2745	2	.34	.97				47,000	85,500	20.0	30.7	.17, .23*	25.0	Dull silky.
2746		.35	.97										
2747	2	.34	.87										
2748	2	.33	.85				40,000	76,000	21.5	30.7	.18, .25*	26.0	Silky.
2749	2	.34	.92										
2750	2	.33	.86				44,500	81,500	16.0	24.0	.14, .18		Amorphous.
2751	2	.40	1.10										
2752	2	.35	1.14				43,000	85,500	21.5	27.4	.23*, .20		Do.
2753	2	.35	.98				44,500	86,500	11.0	13.2	.09, .13*		Do.
2754	2	.38	1.08				36,500	75,000	29.0	43.3	.38*, .20	25.0	Silky.
2755	2	.35	1.03										
2756	1,2	.33	1.02				51,500	101,000	3.5	1.8	.04*, .03	31.0	Fine granular.
							40,000	70,500	31.5	49.1	.39*, .24	23.0	Silky.
							41,000	74,000	26.0	30.7	.30*, .22	21.0	Do.
							57,000	91,500	18.0	27.4	.16, .20*	28.5	Fine granular, 50 per cent; silky, 50 per cent.
2757		.37	1.02										
2758	2	.35	.97										
2759	2	.32	.82				39,000	78,000	27.0	40.3	.34*, .20	25.0	Silky.
2760	2	.31	.82										
2761	2	.32	.95				39,000	75,000	19.5	27.4	.18*, .21*	25.0	Amorphous.
2762	2	.30	.82										
2763	2	.31	.92										
2764	2	.30	.86										
2765	2	.29	.95				52,500	85,000	20.0	20.5	.18, .22*	25.0	Silky.
2766		.32	.88										
2767	2	.37	.87				36,500	82,000	17.0	16.9	.16, .18*	26.0	Dull silky spot at circumference.
							37,000	81,500	16.5	16.9	.16, .17*	27.0	Granular.
							50,000	85,000	12.5	9.5	.11, .14*	26.0	Fine granular.
							65,000	99,500	13.5	20.5	.15*, .12	29.0	Amorphous.
2768	2	.33	.96										
2769	2	.35	.89				44,000	83,000	21.5	27.4	.26*, .17	25.0	Dull silky.
2770	2	.33	.85										
2771	2	.32	.84				40,500	79,500	25.5	30.7	.22, .29*	24.0	Do.
2772	2	.32	.81										
2773	2	.41	.96				44,000	81,000	23.0	27.4	.28*, .18	25.0	Do.

2774	2	.34	.84				40,000	80,000	17.5	24.0	.20*, .15	26.0	Silky.
2775	2	.33	.94										
2776	3	.37	.80										
2778		.32	.78				44,000	77,000	18.0	20.5	.20*, .16	20.0	Amorphous.
							55,000	90,500	15.5	20.5	.14, .17*	28.0	Do.
2779	3	.36	.80				40,500	75,500	23.5	27.4	.27*, .20	21.5	Dull silky, trace of granulation.
2780	2	.40	.75				40,000	75,500	26.0	34.0	.30*, .22		Amorphous.
2781	2	.34	.77										
2782	2	.36	.77										
2783		.34	.77				44,000	73,500	23.5	27.4	.20, .27*		Silky.
							53,500	80,500	29.0	49.1	.39*, .19	23.0	Do.
2784	2,3	.31	.70				68,500	104,500	15.5	27.4	.13, .18*	30.5	Silky with light spots at center.
2785		.32	.75										
2786	1	.33	.78				40,000	75,000	28.5	40.3	.33*, .24		Silky.
2787	3	.38	.74										
2788	3	.37	.81				41,500	81,500	23.5	27.4	.23*, .24*	25.5	Dull silky, with trace of granulation.
2789	2	.32	.85				40,500	76,000	24.5	30.7	.27*, .22	25.5	Silky.
2790	2	.31	.70										
2791	2	.32	.11				36,500	74,000	28.5	40.5	.29*, .28*	26.0	Do.
2792		.34	.89										
2793		.33	.85										
2794	2	.33	.80				43,500	81,000	25.0	37.1	.31*, .19	25.0	Do.
2795		.32	.94										
2796	1	.34	.81				40,500	77,000	24.0	34.0	.18, .30*	24.0	Dull silky.
2798		.33	.73										
2799	2	.34	.78				44,500	81,000	21.5	30.7	.17, .26*	24.5	Do.
2800	2	.29	.81										
2801	2	.31	.75				37,500	75,000	31.5	40.3	.32*, .31*	25.0	Silky.
2802		.35	1.10										
2803	2	.33	.90				35,500	76,000	25.0	30.7	.23, .27*	25.5	Dull silky.
2804	3	.37	.81										
2805	3	.38	.85										
2806	2	.38	.99				41,000	79,000	25.0	34.0	.31*, .19	25.0	Dull silky, with trace of granulation.
							39,500	72,500	29.0	43.3	.22, .36*	24.0	Silky.
2807	1,2	.33	.93				47,000	81,500	22.5	30.7	.26*, .19	26.0	Do.
2808	3	.46	.90				46,500	87,500	21.5	24.0	.19, .24*	26.0	Fine granular, 60 per cent; dull silky, 40 per cent.
2809		.32	.73										
2810		.37	.88										
2811	1	.39	.88				36,500	72,500	27.0	37.1	.24, .30*	24.5	Silky.
							34,000	69,500	28.5	40.3	.36*, .21	22.5	Do.
2812	2	.35	.85				58,500	90,000	20.5	34.0	.27*, .14	28.5	Dull silky.
							55,500	84,500	20.5	37.1	.29*, .12	28.0	Silky.
							46,000	83,000	22.5	34.0	.20, .25*	26.0	Do.
2813	2,3	.40	.80				51,000	84,500	22.0	30.7	.27*, .17	27.5	Do.
2814		.33	.91										
2815	2,3	.37	.81				61,500	93,500	14.5	24.0	.11, .18*	27.0	Silky, with two light spots.
							39,500	75,000	23.0	30.7	.24*, .22	24.5	Silky.
2816	1	.33	.77				46,000	78,000	27.5	37.1	.22, .33*	24.5	Dull silky.
2817		.37	1.06										
2818	1	.35	.80				40,500	75,500	24.0	30.7	.20, .28*	22.0	Silky.
2819	1	.40	.91				46,500	83,500	25.0	34.0	.23, .27*	27.0	Fine granular, 50 per cent; silky, 50 per cent.
2820	(1)	.42	.84										
2821	(1)	.40	.79										

Cast steel from Watertown Arsenal steel plant—Continued.

Heat number.	Grade.	Chemical composition.					Elastic limit per sq. in.	Tensile strength per sq. in.	Elongation.	Contraction of area.	Elongation of inch sections.	Scleroscope hardness.	Appearance of fracture.
		Carbon.	Manganese.	Silicon.	Sulphur.	Phosphorus.							
		Per cent.	*Per cent.*	*Per ct.*	*Per ct.*	*Per ct.*	*Lb.*	*Lb.*	*Per cent.*	*Per cent.*	*In. In.*		
2822	.....	0.33	0.81	.....	.....	.....	43,000	79,000	25.5	33.0	0.21, 0.30*	24.0	Silky.
2823	2	.33	.86	.....	.....	.....	42,000	77,500	27.0	34.0	.30*, .24	25.0	Do.
2824	.....	.38	.79	.....	.....	.....							
2825	2	.34	.94	.....	.....	.....							
2826	2	.34	.79	.....	.....	.....	41,500	74,500	27.5	43.3	.37*, .18	23.0	Do.
2827	2	.33	.87	.....	.....	.....	57,500	76,000	26.0	37.1	.33*, .19	24.5	Do.
2828	2	.32	.83	.....	.....	.....	40,500	78,500	25.0	37.1	.30*, .20	23.0	Do.
2829	.....	.35	.72	.....	.....	.....							
2830	2	.34	.71	.....	.....	.....	42,500	79,500	27.0	43.3	.35*, .19	25.0	Dull silky.
2831	.....	.34	.75	.....	.....	.....							
2832	3	.40	.88	.....	.....	.....	47,000	81,500	9.5	13.2	.10*, .09	25.5	Fine granular, silky spot at circumference.
							50,000	91,500	17.5	20.5	.19*, .16	27.5	Fine granular.
2833	2	.34	.83	.....	.....	.....	43,500	75,500	20.5	37.1	.26*, .27*	22.5	Silky.
2834	1	.35	.91	.....	.....	.....	42,500	76,000	29.0	43.3	.30*, .28*	23.0	Do.
2835	.....	.38	.79	.....	.....	.....							
2836	2	.34	.83	.....	.....	.....	41,500	81,500	25.0	37.1	.32*, .18	25.5	Dull silky.
2837	1	.35	.94	.....	.....	.....	44,000	80,500	21.5	27.4	.19, .24*	26.0	Do.
2838	1	.30	.80	.....	.....	.....	38,500	70,000	31.0	49.1	.26, .36*	24.0	Silky.
2839	2	.35	.77	.....	.....	.....	39,000	78,000	27.0	37.1	.23, .31*	25.0	Dull silky
2840	2	.36	.74	.....	.....	.....	39,500	79,500	26.5	34.0	.24, .28*	25.0	Silky.
2841	2	.38	.72	.....	.....	.....	41,000	82,000	24.0	27.4	.24*, .24*	26.0	Do.
2842	2	.35	.71	.....	.....	.....	36,000	71,000	28.0	40.3	.21, .35*	23.0	Do.
							46,000	76,500	27.5	40.3	.21, .34*	23.0	Do.
2843	.....	.36	.73	.....	.....	.....							
2844	.....	.36	.70	.....	.....	.....							
2845	2	.34	.72	.....	.....	.....	35,500	69,500	29.5	43.3	.31*, .28*	25.0	Dull silky.
							51,500	81,000	22.5	30.7	.27*, .18	23.0	Silky, with granular spot.
2846	.....	.37	.91	.....	.....	.....	41,000	82,000	23.5	27.4	.20, .27*	27.0	Granular, 50 per cent; oblique silky, 50 per cent.
2847	1	.33	.94										
2848	2	.35	.86	.....	.....	.....	45,500	83,000	24.0	30.7	.26*, .22	25.5	Dull silky.
2849	.....	.36	.95										
2850	.....	.35	.87	.....	.....	.....	46,000	81,500	24.0	30.7	.28*, .20	23.5	Do.
2851	2	.38	.94										
2852	2	.35	.91	.....	.....	.....	43,500	78,500	25.5	37.1	.32*, .19	24.5	Silky.
2853	.....	.34	.93	.....	.....	.....							
2854	.....	.34	.88	.....	.....	.....							
2855	2	.31	.95	.....	.....	.....	40,500	78,000	27.0	37.1	.27*, .27*	25.0	Do.
2856	1	.30	.97	.....	.....	.....	45,000	78,000	26.0	40.3	.27*, .25*	24.0	Do.

2857	2	.35	1.08				42,000	80,500	23.5	30.7	.18, .29*	25.5	Do.
2858	2	.34	1.00				40,000	79,500	23.5	30.7	.29*, .18	25.0	Do.
2859	3	.39	.84				50,000	91,000	22.0	27.4	.23*, .21*	27.0	Do.
2860	1,2	.33	1.01				40,500	79,000	25.0	34.0	.22, .28*	24.5	Do.
2861		.34	.92										
2862		.33	.75										
2863	2	.35	.88				48,500	82,000	23.5	27.4	.28*, .19	24.5	Do.
2864		.34	.91										
2865		.32	.85										
2866	2	.33	.87				38,500	75,000	28.5	40.3	.22, .35*	23.5	Do.
2867		.35	.90										
2868	1	.30	.88				43,000	74,000	29.5	43.3	.30*, .29*	22.5	Do.
							36,500	78,000	27.5	37.1	.23, .32*	25.0	Do.
2869	3	.37	.88				47,500	83,500	23.0	27.4	.25*, .21	25.0	Silky; fine granular, 30 per cent, near circumference.
							71,500	105,500	15.5	20.5	.12, .19*	34.5	Dull silky.
2870		.33	.93										
2871		.35	.83										
2872		.34	.86										
2873	2	.35	.82										
2874	2	.36	.89				51,000	86,500	23.0	30.7	.20, .26*	26.0	Silky.
2875	2	.34	.87				45,500	76,500	26.5	37.1	.30*, .23	23.0	Do.
2876	2	.33	.87				45,500	83,500	24.5	34.0	.29*, .20	25.0	Do.
2877		.32	.84										
2878	1	.31	.95				46,000	80,000	24.0	37.1	.31*, .17	24.0	Do.
2879		.33	1.10										
2880	2	.33	.92				44,500	84,500	20.5	24.0	.19, .22*	25.0	Dull silky.
2881		.35	.92										
2882	2	.36	.81				46,000	80,500	21.0	27.4	.20, .22*	24.0	Amorphous, 50 per cent; granular, 50 per cent.
							46,500	82,500	28.5	37.1	.35*, .22	25.0	Dull silky.
2883	1,2	.34	.97				55,000	103,500	13.5	16.9	.13*, .14*	31.0	Granular, 90 per cent; amorphous, 10 per cent.
2884		.35	.88										
2885		.34	.81										
2886		.36	.85										
2887		.37	.87										
2888	3	.35	.87				51,000	90,000	21.0	27.4	.22*, .20*	27.0	Amorphous, 50 per cent; granular, 50 per cent.
2889	2	.42	.98				46,000	83,500	25.0	34.0	.19, .31*	25.0	Dull silky with granular spots.
							50,000	88,000	15.5	16.9	.14, .17*	27.0	Granular, 90 per cent; silky, 10 per cent.
2890	2	.39	.90				51,000	87,000	24.5	20.5	.17, .32*	26.0	Granular, 70 per cent; silky, 30 per cent.
2891		.41	.86										
2892		.40	.88										
2893		.41	.82										
2894		.38	.83										
2895	2	.40	.86				48,700	85,900	16.5	16.6	.17*, .16*	26.5	Granular, 75 per cent; amorphous, 25 per cent.
2896	2						45,500	80,500	25.0	34.0	.27*, .23*	25.0	Silky.
2897		.40	.93										
2898	1,2	.40	.87				46,000	82,500	25.5	37.1	.19, .32*	27.0	Dull silky.
2899													
2900		.42	.91										
2901	2	.42	.88				51,500	93,500	13.5	13.2	.12, .15*	29.0	Fine granular, amorphous spot near circumference.
							46,000	83,100	23.5	34.0	.19, .28*	25.0	Dull silky.
2902		.40	.83										
2903	3	.42	.81				45,000	89,500	22.0	24.0	.19, .25*	27.0	Granular, 75 per cent; silky, 25 per cent.

Cast steel from Watertown Arsenal steel plant—Continued.

Heat number.	Grade.	Chemical composition.					Elastic limit per sq. in.	Tensile strength per sq. in.	Elongation.	Contraction of area.	Elongation of inch sections.		Sclero-scope hard-ness.	Appearance of fracture.
		Carbon.	Manga-nese.	Sili-con.	Sul-phur.	Phos-phorus.								
		Per cent.	*Per cent.*	*Per ct.*	*Per ct.*	*Per ct.*	*Lb.*	*Lb.*	*Per cent.*	*Per cent.*	*In.*	*In.*		
2904	1,2	.....	.....	.....	.....	.....	46,000	81,000	24.0	30.7	.20,	.28*	24.0	Silky.
2905	1,2	0.35	0.81	.....	.....	.....								
2906	2	.....	.....	.....	.....	.....	38,500	77,000	28.0	46.2	.18,	.38*	23.0	Do.
2907	(1)	.36	.98	.....	.....	.....	50,000	81,000	25.5	43.3	.34*,	.17	25.0	Do.
2908	2	.36	.91	.....	.....	.....	44,500	77,000	24.5	27.4	.26*,	.23	22.5	Dull silky.
2909	2	.....	.....	.....	.....	.....	39,000	75,000	26.0	37.1	.22,	.30*	25.0	Silky.
2910	2	.....	.....	.....	.....	.....	46,500	85,000	24.0	37.1	.20,	.28*	26.0	Do.
2911	.....	.37	.91	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
2912	2	.38	.77	.....	.....	.....	49,500	84,500	26.5	46.2	.19,	.34*	25.0	Do.
2913	2	.....	.....	.....	.....	.....	46,000	79,000	25.0	34.0	.24*,	.26*	24.5	Dull silky.
							43,500	82,000	11.5	13.2	.13*,	.10	.....	Granular, 85 per cent; silky, 15 per cent.
2914	.....	.40	.90	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
2915	2	.37	.73	.....	.....	.....	41,000	76,000	27.5	34.0	.25,	.30*	23.0	Silky.
				.....	.....	.....	58,000	95,500	20.0	40.3	.29*,	.11	29.0	Dull silky.
2916	(1)	.40	.83	.....	.....	.....	46,000	81,500	22.0	27.4	.18,	.26*	25.0	Silky.
2917	(1)	.....	.....	.....	.....	.....								
2918	.....	.36	.72	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
2919	1	.36	.83	.....	.....	.....	46,500	83,000	22.5	24.0	.23*,	.22*	27.0	Do.
2920	1	.34	.87	.....	.....	.....	49,500	84,000	18.5	24.0	.16,	.21*	27.0	Do.
2921	1	.38	.94	.....	.....	.....								
2922	2	.37	.82	.....	.....	.....	42,500	80,500	25.0	34.0	.31*,	.19	25.0	Do.
2923	2	.38	.88	.....	.....	.....								
2924	2	.36	.83	.....	.....	.....	38,500	72,000	29.0	43.3	.25,	.33*	23.0	Silky, oblique.
2925	2	.34	1.02	.....	.....	.....	46,500	83,000	26.0	43.3	.35*,	.17	25.0	Do.
2926	2	.41	.96	.....	.....	.....	46,500	82,500	20.0	24.0	.20*,	.20	25.0	Silky.
2927	.....	.36	.95	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
2928	.....	.40	.98	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
2929	2,3	.39	.96	.....	.....	.....	44,500	80,000	26.0	37.1	.27*,	.25*	24.0	Silky, oblique.
2930	2,3	.39	.97	.....	.....	.....	60,500	92,000	15.0	20.5	.15*,	.15*	28.0	Do.
2931	2	.36	.95	.....	.....	.....	44,500	78,500	26.0	34.0	.31*,	.21	24.0	Amorphous.
2932	2	.37	.90	.....	.....	.....	49,000	80,000	26.5	46.2	.23,	.30*	24.5	Dull silky.
2933	2	.38	.94	.....	.....	.....								
2934	.....	.40	.89	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
2935	.....	.40	.75	.....	.....	.....	60,500	92,500	14.0	16.9	.13,	.15*	29.0	Fine granular, 95 per cent; silky, 5 per cent.
2936	.....	.....	.....	.....	.....	.....								
2937	(1)	.34	.82	.....	.....	.....	50,000	80,500	26.0	49.1	.15,	.37*	25.0	Silky.
2938	(1)	.44	.89	.....	.....	.....								
2939	.....	.34	.91	.....	.....	.....	48,500	80,000	31.5	46.2	.26,	.37*	26.0	Do.
2940	.....	.35	.91	.....	.....	.....								

2941	2	.36	.87				38,500	73,500	26.5	40.3	.29*, .23*	24.0	Do.
2942	(1)	.33	.97				51,000	81,500	25.5	43.3	.31*, .20	25.0	Dull silky.
2943	2,3	.40	.98				49,500	81,500	28.0	43.5	.36*, .20	26.0	Silky.
2944	2,3	.42	.92				59,000	92,000	22.5	30.7	.18, .27*	27.0	Do.
2945		.40	.85										
2946	2,3	.42	.81				40,500	79,000	26.5	34.0	.23, .30*	24.0	Silky, trace of granulation.
	3						47,500	85,500	25.5	43.3	.16, .35*	26.0	Dull silky.
2947	(1)	.38	.78				39,500	72,000	26.0	37.1	.28*, .24	24.0	Do.
2948	(1)	.37	.81				45,500	78,000	28.0	40.3	.20, .36*	22.5	Silky.
							44,000	78,500	28.5	49.1	.27, .30*	24.0	Do.
2949	(1)	.37	.80				46,500	77,000	16.5	24.0	.20*, .13	25.0	Do.
							49,000	78,000	31.5	43.3	.34*, .29*	25.0	Do.
2950	(1)	.36	.78				55,500	93,000	15.0	16.9	.17*, .13	29.0	Dull silky.
							53,500	86,000	13.0	16.9	.11, .15*	28.0	Silky.
							52,000	89,500	19.5	20.5	.22*, .17	26.0	Amorphous, 60 per cent; fine granular, 40 per cent.
2951	3	.38	.80				41,000	80,000	24.5	27.4	.27*, .22	25.0	Dull silky.
							50,000	91,500	21.0	30.7	.26*, .22	29.0	Silky, 90 per cent; granular, 10 per cent.
							43,000	80,500	13.0	16.9	.15*, .11	26.0	Silky, 20 per cent; coarse granular, 80 per cent.
2953	3	.43	.84				54,500	102,500	16.0	16.9	.18*, .14	31.0	Granular, 85 per cent; silky, 15 per cent.
							46,000	83,000	19.5	24.0	.19, .20*	24.5	Silky, trace of granulation.
							57,500	94,000	14.5	20.5	.17*, .12	29.5	Amorphous, 75 per cent; granular, 25 per cent.
2954	(1)	.38	.80				44,500	76,500	28.5	40.3	.28*, .29*	25.0	Silky.
2955	(1)	.37	.86				45,500	76,500	23.5	27.4	.25*, .22*	25.0	Dull silky, 90 per cent; granular, 10 per cent.
							54,500	85,500	22.5	27.4	.19, .26*	26.0	Silky.
2956	(1)	.39	.98				31,500	68,000	26.5	40.3	.25, .28*	22.0	Dull silky, oblique.
2957	(1)	.36	.78				44,500	83,000	27.0	34.0	.34*, .20	26.0	Silky, oblique.
2958	3	.41	.77				42,000	77,500	26.5	37.1	.21, .32*	22.0	Dull silky.
							50,500	85,500	20.5	27.4	.23*, .18	27.0	Do.
2959	3	.44	.80				44,500	80,000	25.5	30.7	.30*, .21	25.0	Silky, 70 per cent; fine granular, 30 per cent.
							58,500	89,500	17.0	20.5	.15, .19*	27.0	Dull silky.
2960	3	.42	.85				51,000	86,000	22.5	30.7	.18, .27*	26.0	Silky.
2961	1,3	.42	.95				43,500	83,000	24.0	34.0	.19, .29*	25.0	Do
2962		.40	1.03										
2963	3						56,000	92,000	18.5	27.4	.15, .22*	29.0	Amorphous.
2964	(1)	.38	.81				43,500	82,000	25.5	37.1	.31*, .20	24.5	Silky.
2965		.40	.92										
2966	(1)	.38	.78				30,500	68,500	31.5	43.3	.25, .38*	23.0	Do.
2967	(1)	.39	.84				56,500	90,500	22.0	37.1	.24*, .20	28.0	Dull silky.
2968	3	.40	.87				36,000	78,500	25.5	34.0	.30*, .21	25.0	Silky, trace of granulation.
							49,500	88,000	22.0	34.0	.27*, .17	26.0	Silky.
2969	3	.40	.91				40,500	78,500	26.0	30.7	.33*, .19	25.0	Silky, trace of granulation.
							50,500	87,500	21.0	27.4	.26, .16	25.0	Silky.
2970	3	.42	.81				50,500	90,000	24.5	30.7	.24, .25*	26.0	Silky, 60 per cent; fine granular, 40 per cent.
2971	3	.41	.81				48,000	85,500	17.0	16.9	.19, .15	25.0	Silky, 20 per cent; granular, 80 per cent.
							68,000	99,000	17.0	20.5	.15, .19*	28.0	Fine granular, 70 per cent; silky, 30 per cent.
2972	1	.42	.88										
2973	1	.36	.89				43,500	83,000	22.0	24.0	.22*, .22*	25.0	Silky, 70 per cent; granular, 30 per cent.
2974		.38	.76										
2975	3	.44	.84				45,000	85,000	23.0	30.7	.25*, .21	25.5	Silky, 90 per cent; granular, 10 per cent.
2977	3	.43	.94				53,000	88,500	20.0	27.4	.21*, .19*	26.0	Silky.

[1] No. 1 Navy.

Cast steel from Watertown Arsenal steel plant—Continued.

Heat number.	Grade.	Chemical composition.					Elastic limit per sq. in.	Tensile strength per sq. in.	Elongation.	Contraction of area.	Elongation of inch sections.	Sclero-scope hardness.	Appearance of fracture.
		Carbon.	Manganese.	Silicon.	Sulphur.	Phosphorus.							
		Per cent.	*Per cent.*	*Per ct.*	*Per ct.*	*Per ct.*	*Lb.*	*Lb.*	*Per cent.*	*Per cent.*	*In.* *In.*		
2978	3	0.43	0.80	.....	.....	.....	43,000	78,000	26.0	34.0	.31*, .21	24.0	Silky, 90 per cent; granular, 10 per cent.
							52,500	85,500	16.5	20.5	.19*, .14	25.0	Dull silky.
2979	.....	.42	.86										
2980	(1)	.37	.87	.....	.....	.....	40,500	80,500	22.0	30.7	.27*, .17	25.5	Silky, 40 per cent; granular, 60 per cent.
2981	(1)	.38	.88	.....	.....	.....							
2982	(1)	.37	.82	.....	.....	.....	41,000	72,000	9.5	13.2	.11*, .08	23.0	Granular, 60 per cent; amorphous, 40 per cent.
2983	(1)	.40	.90	.....	.....	.....	45,500	83,000	13.5	16.9	.13, .14*	27.0	Fine granular, 70 per cent; amorphous, 30 per cent.
							45,500	83,000	20.5	27.4	.23*, .18	25.0	Dull silky, 30 per cent; fine granular, 70 per cent.
							55,000	95,000	15.5	16.9	.18*, .13	29.0	Fine granular, 45 per cent; amorphous, 55 per cent.
2984	.....	.42	.78	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
2985	.....	.41	.79	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
2986	.....	.42	.80	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
2987	.....	.38	.76	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
2988	3	.41	.81	.....	.....	.....	54,000	88,000	21.5	30.7	.18, .25*	28.0	Silky.
2989	(1)	.....	.....	.....	.....	.....	38,500	78,000	23.5	43.3	.29*, .18	25.0	Dull silky. trace of granulation.
2990	(1)	.38	.76	.....	.....	.....	56,500	89,500	16.0	20.5	.18*, .14	27.5	Dull silky.
							51,500	86,000	20.0	27.4	.24*, .16	25.0	Silky.
2991	.....	.42	.87	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
2992	3	.45	.76	.....	.....	.....	67,000	98,000	8.5	13.2	.07, .10*	29.0	Dull silky.
							45,500	85,000	24.0	27.4	.24*, .24	27.0	Dull silky, 50 per cent; granular, 50 per cent.
2993	3	.43	.87	.....	.....	.....	47,500	84,000	25.0	37.1	.27*, .23	27.0	Silky.
							59,000	92,500	14.5	20.5	.17*, .12	30.0	Amorphous.
2994	3	.44	.91	.....	.....	.....	44,500	80,500	28.0	43.3	.33*, .23	25.5	Dull silky.
							55,000	93,000	19.0	27.4	.22*, .16	29.0	Do.
2995	(1)	.38	.86	.....	.....	.....	42,000	79,500	21.5	24.0	.19, .24*	26.0	Dull silky, 40 per cent; granular, 60 per cent.
2996	3	.42	.84	.....	.....	.....	48,000	86,000	15.0	16.9	.16*, .14	28.0	Fine granular, silky spot at circumference.
							58,500	92,500	19.5	24.0	.25*, .16	29.0	Amorphous.
							58,000	89,500	14.5	16.9	.17*, .12	28.0	Do.
							45,500	82,000	26.0	40.3	.22, .30	26.0	Silky.
2997	(1)	.41	.72	.....	.....	.....	50,000	92,000	20.5	27.4	.20*, .21*	27.0	Do.
2999	3	.42	.94	.....	.....	.....	43,000	82,500	14.5	16.9	.16*, .13	26.0	Granular, silky spot at circumference.
							56,000	92,000	15.0	20.5	.13, .17*	30.0	Amorphous.
3000	3	.42	.86	.....	.....	.....	44,500	84,000	16.5	16.9	.18*, .15	26.0	Fine granular; amorphous spot near circumference.
							49,500	87,500	13.5	20.5	.11, .16*	27.0	Amorphous.
3001	3	.39	.86	.....	.....	.....	45,500	80,500	20.0	24.0	.18, .22*	25.0	Granular, 70 per cent; dull silky, 30 per cent.
							55,000	91,000	22.5	24.0	.25*, .20	29.0	Silky, oblique.
3002	3	.41	.98	.....	.....	.....	51,000	84,500	20.0	24.0	.18, .22*	27.0	Fine granular, 50 per cent; amorphous, 50 per cent.

3003	3	.42	.98				48,500	80,500	9.0	16.9	.07, .11*	28.0	Amorphous.
							45,000	85,000	16.5	20.5	.16, .17*	28.0	Fine granular, silky spot at circumference.
3004	3	.38	1.00				50,500	87,000	13.0	13.2	.14*, .12	26.0	Granular, 75 per cent; dull silky, 25 per cent.
							50,000	87,500	15.0	20.5	.14, .16*	28.0	Amorphous.
3005	2	.38	.98				48,000	82,000	20.0	24.0	.20, .20*	25.0	Granular, 30 per cent; dull silky, 70 per cent.
3006	3	.42	.86				47,000	90,500	18.0	27.4	.20*, .16	31.0	Silky.
							55,500	89,500	16.5	20.5	.14, .19*	27.0	Amorphous.
3007	3	.41	.90				46,500	86,000	14.0	16.9	.16*, .12	26.0	Amorphous, 80 per cent; granular, 20 per cent.
							51,000	92,500	17.5	24.0	.16, .19*	28.0	Silky.
3008	2,3	.39	.87				47,000	83,000	14.0	16.9	.13, .15*	25.5	Granular, 60 per cent; dull silky, 40 per cent.
							49,500	82,500	20.0	24.0	.23*, .17	25.5	Amorphous, 60 per cent; granular, 40 per cent.
3009	(1)						51,500	93,000	16.5	16.9	.20*, .13	28.5	Fine granular, 70 per cent; amorphous, 30 per cent.
							50,000	87,000	23.0	30.7	.23*, .23*	26.0	Dull silky.
3010	2						42,500	80,500	24.5	30.7	.23*, .26*	25.0	Fine silky, oblique.
3011	3	.38	.94				54,000	92,500	15.5	20.5	.14, .17*	26.0	Silky, oblique.
3012	3	.40	.90				56,500	85,500	14.5	24.0	.13, .16*	27.0	Amorphous.
							47,000	84,000	12.0	13.2	.13*, .11	28.0	Fine granular, 60 per cent; amorphous, 40 per cent.
3013	2	.34	.82				50,000	83,200	14.5	13.2	.14, .15*	27.0	Fine granular, amorphous spot at circumference.
							50,500	83,500	18.5	24.0	.20*, .17	27.0	Dull silky.
							52,000	86,500	18.0	24.0	.20*, .16	25.5	Fine granular, 40 per cent; amorphous, 60 per cent.
3014	3	.34	.77				47,500	85,000	19.5	20.5	.17, .22*	26.0	Fine granular, 60 per cent; amorphous, 40 per cent.
3015	3	.35	.85				37,500	78,500	22.0	30.7	.19, .25*	25.0	Amorphous, trace of granulation.
							48,500	88,000	20.0	24.0	.17, .23*	29.0	Dull silky.
3016	3	.36	.80				40,500	79,500	19.0	20.5	.21*, .17	25.5	Amorphous.
							53,500	88,000	18.5	24.0	.16, .21*	27.0	Dull silky.
3017	3	.36	.75				42,000	77,000	25.0	37.1	.27*, .23	25.0	Do.
							53,000	87,000	17.5	24.0	.16, .19*	27.0	Do.
							43,500	83,000	15.0	16.9	.16*, .14	26.0	Granular, silky spot at circumference.
							77,500	124,500	13.5	24.0	.14*, .13	37.0	Fine granular, amorphous spot near circumference.
3018	1,2,3	.35	.75				48,000	86,000	15.5	16.9	.17*, .14	28.0	Fine granular, silky spot at circumference.
							74,500	118,000	16.5	37.1	.23*, .10	37.0	Dull silky, 50 per cent; granular, 50 per cent.
							49,500	85,000	27.5	46.2	.29*, .26*	28.0	Silky.
							44,000	80,500	14.0	16.9	.13, .15*	26.0	Fine granular, 50 per cent; amorphous, 50 per cent.
3019	3	.35	.78				43,500	89,500	20.5	27.4	.26*, .15	28.0	Dull silky, 25 per cent; granular, 75 per cent.
							63,000	104,000	13.0	13.2	.12, .14*	32.0	Granular, 85 per cent; silky, 15 per cent.
							50,500	93,000	14.5	20.5	.13, .16*	29.0	Amorphous, 70 per cent; fine granular, 30 per cent.
3020	3	.37	.81				52,000	88,000	19.5	27.4	.21*, .18	28.0	Fine granular, 70 per cent; silky, 30 per cent.
3022	2	.35	.86				45,000	80,000	12.5	16.9	.13*, .12	26.0	Granular, 60 per cent; amorphous, 40 per cent.
							51,500	91,500	21.5	27.4	.21*, .22	26.0	Silky.
3023	3	.38	.79				45,000	75,000	26.5	37.1	.31*, .22	24.0	Do.
							44,000	80,000	18.0	27.4	.21*, .15	26.0	Do.
							54,500	85,000	23.0	34.0	.24, .22	26.0	Do.
3024	3	.34	.85				54,500	85,500	23.5	30.7	.21, .26*	25.0	Do.
3025, 3026	2	.38	.79				54,000	87,000	20.0	27.4	.23*, .17	26.0	Dull silky.
3027	2	.36	.83				40,500	74,000	28.5	40.3	.33*, .24	23.5	Silky.
3028							49,500	85,500	22.0	30.7	.25*, .19	27.0	Amorphous.
							32,500	62,000	32.0	51.9	.38*, .26	22.0	Silky.
3029	3	.38	.77				45,000	70,000	25.0	27.4	.22, .28*	24.0	Do.
							50,000	85,500	24.0	27.4	.26*, .22	26.0	Amorphous, 40 per cent; fine granular, 60 per cent.

[1] No. 1 Navy.

Cast steel from Watertown Arsenal steel plant—Continued.

Heat number.	Grade.	Chemical composition.					Elastic limit per sq. in.	Tensile strength per sq. in.	Elongation.	Contraction of area.	Elongation of inch sections.		Scleroscope hardness.	Appearance of fracture.
		Carbon.	Manganese.	Silicon.	Sulphur.	Phosphorus.								
		Per cent.	*Per cent.*	*Per ct.*	*Per ct.*	*Per ct.*	*Lb.*	*Lb.*	*Per cent.*	*Per cent.*	*In.*	*In.*		
3030	3	0.37	0.75				44,000	82,000	22.5	30.7	.20,	.25*	26.0	Dull silky, 40 per cent; granular, 60 per cent.
							57,500	90,000	15.5	20.5	.15,	.16*	28.0	Dull silky, 80 per cent; granular, 20 per cent.
3031	3	.36	.77				45,000	87,500	23.0	37.1	.30*,	.16	28.0	Silky.
3032	3	.36	.80				51,000	94,000	18.5	20.5	.21*,	.16	26.0	Amorphous, 50 per cent; fine granular, 50 per cent.
3033	2,3	.38	.81				52,500	86,500	25.0	34.0	.20,	.30*	25.5	Silky.
							43,500	78,500	23.0	30.7	.23*,	.23*	23.0	Dull silky, trace of granulation.
3034							43,000	81,000	22.5	30.7	.26*,	.19	26.0	Amorphous.
							54,500	87,500	15.5	20.5	.16*,	.15*	29.0	Silky.
							38,000	72,500	26.5	34.0	.29*,	.24	23.0	Dull silky.
3035	2,3	.37	.83				50,500	80,000	20.0	27.4	.17,	.23*	24.0	Amorphous.
							45,500	87,000	17.0	24.0	.20,	.14	26.0	Dull silky, with granular spot near circumference.
3036	3	.34	.84				53,500	90,000	16.5	20.5	.15,	.18*	26.0	Amorphous, 50 per cent; fine granular, 50 per cent.
3037		.41	.85											
3038	3	.40	.78				60,000	89,500	14.5	20.5	.16*,	.13	27.0	Silky.
3039	2,3	.39	.78				45,500	87,000	23.5	37.1	.18,	.29*	28.0	Dull silky, 60 per cent; fine granular, 40 per cent.
							54,000	88,500	10.0	9.5	.10,	.10	28.0	Fine granular, 60 per cent; amorphous, 40 per cent.
3040	2,3	.36	.92				55,000	86,000	7.0	9.5	.07*,	.07	28.0	Fine granular, 75 per cent; amorphous, 25 per cent.
3041							46,500	87,000	17.0	20.5	.20*,	.14	27.0	Dull silky, with 3 small granular spots.
3042	3	.39	.88				51,000	90,000	17.5	20 5	.19,	.16	28.0	Fine granular, 75 per cent; amorphous, 25 per cent.
3043	3	.40	.90				57,000	99,000	13.5	16.9	.14*,	.13	28.0	Amorphous, 20 per cent; fine granular, 80 per cent.
							50,000	86,500	16.5	20.5	.17*,	.16*	27.0	Amorphous, trace of granulation.
							42,500	76,000	24.0	30.7	.22,	.26*	23.5	Silky.
3044	2,3	.41	.99				50,500	79,000	24.0	30.7	.28*,	.20	27.0	Do.
							48,500	87,500	11.5	16.9	.10,	.13*	27.5	Fine granular; silky spot at circumference.
3045	3	.38	.93				44,500	87,000	22.5	30.7	.28*,	.17	25.0	Fine granular.
3046		.36	.77											
3048	2,3	.34	.88				52,500	88,500	10.5	13.2	.10,	.11*	27.5	Fine granular, 85 per cent; amorphous, 15 per cent.
3049							55,000	82,000	6.5	9.5	.08,	.05	27.5	Amorphous, 50 per cent; fine granular, 50 per cent.
							54,000	88,000	20.0	24.0	.19,	.21*	27.0	Silky oblique.
3050	2,3	.40	.83				54,500	84,000	8.0	9.5	.06,	.10*	28.5	Fine granular, 40 per cent; amorphous, 60 per cent.
							53,500	85,000	21.5	30.7	.18,	.25*	24.0	Silky.
3051	3	.34	.86				49,000	85,500	18.0	24.0	.16,	.20*	27.0	Do.
3052	3	.39	.76				42,000	83,500	22.0	30.7	.23*,	.21	26.0	Amorphous.
3053		.34	.83											
3055	(1)	.33	.74				49,500	92,000	12.5	13.2	.14*,	.11	28.0	Fine granular, 50 per cent; amorphous, 50 per cent.
3056							52,500	86,500	19.5	27.4	.23*,	.16	25.5	Silky, oblique.
3057	2,3	.42	.75				41,500	82,500	24.5	30.7	.30*,	.19	25.5	Amorphous. 70 per cent; fine granular, 30 per cent.
							57,000	93,500	14.5	20.5	.14,	.15*	27.5	Silky.

3058	3	.35	.79				38,500	80,000	25.5	30.7	.21, .30*	26.0	Amorphous, with trace of granulation.
3059		.45	.74										
3060		.42	.85										
3061	(1)	.40	.74				50,000	88,000	14.0	16.9	.15*, .13	27.0	Fine granular, silky spot at circumference.
3062							49,000	90,000	17.0	20.5	.18*, .16	26.5	Do.
3063	2	.36	.74				44,500	82,000	23.0	30.7	.17 , .29*	26.5	Dull silky, trace of granulation.
3064							42,000	82,000	24.5	30.7	.22 , .27*	27.0	Amorphous, trace of granulation.
3065	2,3	.36	.82				49,500	91,000	18.5	20.5	.21*, .16	27.5	Amorphous, 20 per cent; granular, 80 per cent.
3066	3	.38	.90				50,500	90,000	22.5	34.0	.26*, .19	28.0	Silky.
3067	3	.39	.72				42,500	78,000	25.0	34.0	.25 , .25*	24.5	Do.
3068	(2)	.39	.73				55,500	87,000	19.0	24.0	.19*, .19	26.0	Amorphous.
3069		.35	.81				51,000	92,000	20.5	27.4	.19 , .22*	27.0	Silky.
3070	2,3	.37	.75				39,000	77,500	25.0	34.0	.23 , .27*	24.0	Do.
3071	2	.32	.72				52,000	91,500	14.0	20.5	.12 , .16*	27.0	Amorphous.
3072	3	.42	.83				43,000	84,500	21.5	27.4	.24*, .19	25.0	Silky.
3073	3	.39	.83				43,000	79,500	25.0	27.4	.23 , .27*	25.0	Do.
3074	2	.44	.74				54,000	83,000	7.0	9.5	.08*, .04	29.0	Fine granular, 60 per cent; amorphous, 40 per cent.
3075	2	.37	.89				59,500	100,000	17.0	24.0	.19*, .15	29.0	Amorphous, 30 per cent; fine granular, 70 per cent.
3076	2	.31	.89				56,000	93,500	17.0	24.0	.14 , .20*	27.0	Silky.
3077		.36	.78				60,000	99,000	17.0	20.5	.19*, .15	28.0	Amorphous, 30 per cent; fine granular, 70 per cent.
3078	2	.36	.74				48,500	84,500	16.0	20.5	.17*, .15	26.0	Amorphous.
3079	3	.41	.81				43,500	78,500	26.5	37.1	.34*, .19	26.0	Amorphous, trace of granulation.
3080	3	.42	.83				49,500	85,500	18.0	20.5	.20*, .16	26.0	Amorphous.
3081	3	.41	.78				50,500	92,500	13.0	13.2	.15*, .11	28.0	Amorphous, 20 per cent; fine granular, 80 per cent.
3082	2	.36	.69				50,500	86,000	11.5	16.9	.10 , .13*	26.0	Amorphous, trace of granulation.
3083	2,3	.35	.71				44,500	77,500	29.5	46.2	.30 , .29*	24.0	Silky.
3084	2	.39	.84				50,000	85,500	19.5	24.0	.23*, .16	26.0	Amorphous.
3085	3	.35	.81				46,000	81,500	11.5	16.9	.10 , .13*	25.5	Amorphous, 20 per cent; fine granular, 80 per cent.
3086	2	.32	.78				40,500	79,000	24.0	30.7	.28*, .20	25.0	Amorphous, 50 per cent; fine granular, 50 per cent.
3087	(3)	.36	.78				43,500	81,000	23.0	30.7	.22 , .24*	25.0	Amorphous, 60 per cent; fine granular, 40 per cent.
3088	(1)	.80	.97				39,500	77,000	25.0	34.0	.31*, .19	24.0	Amorphous.
3089	3	.40	.64				41,500	75,000	26.5	37.1	.33*, .20	24.0	Amorphous, trace of granulation.
3090	2	.33	.92				46,000	84,000	24.0	30.7	.30*, .18	26.0	Do.
3091	(1)	.33	.84				40,000	79,000	23.0	34.0	.25*, .21	25.0	Do.
3092							52,500	117,500	5.5	9.5	.05 , .06*	37.0	Granular.
3093	2	.38	.84				51,000	85,000	11.5	20.5	.10 , .13*	26.0	Amorphous, trace of granulation.
3094	2	.40	.81				40,500	76,500	25.0	30.7	.22*, .28*	24.0	Do.
							53,000	83,500	10.5	20.5	.09 , .12*	25.5	Do.
							45,500	83,000	22.5	30.7	.18 , .27*	25.5	Do.
							45,000	80,000	21.5	27.4	.25*, .18	24.0	Amorphous, 40 per cent; fine granular, 60 per cent.
							52,000	84,000	11.0	13.2	.10 , .12*	25.5	Amorphous, 20 per cent; fine granular, 80 per cent.

[1] No. 1 Navy.

[2] No. 1 and 2 Navy.

[3] No. 1, 2, and 3 Navy.

STEEL FORGINGS FOR ORDNANCE WORK.

FORGED STEEL FROM WATERTOWN ARSENAL SMITH SHOP.

[The inch in which fracture occurred is marked thus *.]

Marks.	Grade.	Elastic limit per sq. in.	Tensile strength per sq. in.	Elongation.	Contraction of area.	Elongation of inch. sections.	Scleroscope hardness.	Appearance of fracture.
		Lb.	*Lb.*	*Per ct.*	*Per ct.*	*In.*		
207F.	3	57,500	84,500	29.5	62.2	0.23, 0.36*	.....	Silky; cup shaped.
207F-2	.....	60,200	83,100	32.0	57.2	.47,* .17	.....	Do.
207F-3	.....	62,500	97,000	23.0	59.8	.14, .32*	.....	Do.
222F	2	72,900	97,400	13.5	54.6	.11, .16*	.....	Dull silky; cup shaped.
222F-2	.....	69,500	100,000	24.0	57.2	.31,* .17	.....	Silky; slightly cup shaped.
255F	3	47,900	69,900	33.5	64.5	.28, .39*	.....	Silky; cup shaped.
255F-2	.....	59,000	84,500	26.5	66.9	.11, .42*	.....	Silky; partly cupped.
255F-3	.....	53,000	78,000	27.0	73.4	.10, .44*	.....	Silky.
255F-4	.....	72,300	88,000	23.0	66.9	.38,* .08	.....	Do.
256F	D	70,500	101,000	24.0	49.1	.15, .33*	.....	Silky; ½ cup shaped.
256F-2	.....	95,000	121,000	18.0	49.1	.10, .26*	.....	Dull silky; cup shaped.
256F-3	.....	85,500	110,500	20.5	46.2	.25,* .16	.....	Do.
256F-4	.....	100,000	121,000	17.0	51.9	.05, .29*	.....	Fine silky; cup shaped.
257F	3	49,500	82,000	24.0	43.3	.32,* .16	.....	Gray amorphous.
257F-2	.....	39,000	82,000	24.0	43.3	.14, .34*	.....	Silky.
257F-3	.....	46,000	81,000	29.0	57.2	.40,* .18	.....	Do.
257F-4	.....	56,000	92,500	23.0	49.1	.34,* .12	.....	Do.
257F-5	.....	52,000	91,500	24.0	49.1	.14, .34*	.....	Do.
291F	B	59,000	93,500	22.0	54.0	.35,* .09	.....	Silky; cup shaped.
291F-2	.....	88,500	115,000	19.0	57.2	.07, .31*	.....	Silky.
295F	1	44,000	83,000	26.5	46.2	.18, .35*	.....	Do.
297F	2	59,500	84,500	22.0	59.8	.35,* .09	.....	Do.
354F	3	94,500	118,000	20.0	57.2	.23,* .17	.....	Silky; cup shaped.
380F	A	67,500	110,000	23.0	51.9	.33,* .13	.....	Silky.
381F	3	56,000	91,500	20.0	51.9	.32,* .08	.....	Do.
398F	3	74,500	81,000	15.5	46.2	.20,* .11	.....	Fine silky.
398F-2	.....	52,500	94,000	23.5	46.2	.20, .27*	.....	Silky.
417F	3	47,000	88,000	27.5	46.2	.21, .34*	.....	Fine silky.
417F-2	.....	64,500	105,500	14.5	37.1	.07, .22*	.....	Silky.
417F-3	.....	53,000	94,000	25.0	51.9	.15, .35*	.....	Fine silky.
431F	D	120,000	136,000	16.5	49.1	.22,* .11	.....	Fine silky; cup shaped.
452F	2	57,000	93,500	24.0	46.2	.34,* .14	.....	Silky.
485F	C	63,000	97,000	15.5	16.9	.18,* .13	.....	Fine granular.
485F-2	.....	68,000	104,500	13.5	16.9	.12, .15*	.....	Silky.
485F-3	.....	60,500	96,500	21.0	49.1	.33,* .09	.....	Fine silky.
485F-4	.....	73,500	112,000	16.5	34.0	.23,* .10	.....	Silky.
486F	3	44,500	78,500	31.0	54.6	.24, .38*	.....	Do.
486F-2	.....	76,500	104,000	25.0	51.9	.14, .36*	.....	Fine silky.
531F	2	42,500	81,500	26.5	49.1	.35,* .18	.....	Do.
531F-2	3	54,000	96,000	25.0	37.1	.22,* .28*	.....	Silky.
549F	2	62,500	92,500	25.0	49.1	.34,* .16	.....	Do.
565F [1]	.....	122,000	136,500	15.0	54.6	.05, .25*	.....	Silky; cup shaped.
565F-2	3	90,000	113,000	17.0	59.8	.29,* .05	.....	Fine silky.
567F	2,3	47,000	78,500	26.5	59.8	.39,* .14	.....	Silky.
567F-2	3	98,000	140,500	16.5	37.1	.09, .24*	.....	Do.
614F	3	49,000	78,000	27.0	51.9	.38,* .16	.....	Do.
614F-2	.....	51,000	91,500	24.5	51.9	.34,* .15	.....	Do.
614F-3	.....	53,000	91,500	23.5	51.9	.11, .36*	.....	Do.
615F	3	48,000	80,000	28.5	49.1	.23, .34*	.....	Do.
615F-2	.....	50,000	90,000	22.5	49.1	.34,* .11	.....	Do.
621F	3	51,000	90,000	20.0	40.3	.12, .28*	.....	Do.
621F-2	.....	49,000	89,500	19.0	43.3	.10, .28	.....	Do.
630F	2	40,500	80,000	30.0	51.9	.22, .38*	.....	Do.
639F	3	57,500	105,000	17.0	51.9	.28,* .06	.....	Fine silky.
655F	3	46,000	75,500	31.5	54.6	.21, .42*	.....	Do.
655F-2	.....	72,000	110,000	21.5	51.9	.14, .29*	.....	Silky.
671F	C	62,500	107,500	20.5	43.3	.28,* .13	.....	Do.
671F-2	.....	72,000	108,500	9.0	9.5	.09, .09	.....	Fine granular, 60 per cent; silky, 40 per cent.
671F-3	.....	71,000	108,000	16.5	24.0	.11, .22*	.....	Silky.
671F-4	.....	106,000	123,000	3.5	5.7	.05, .02	.....	Granular.
672F	D	77,500	116,000	20.0	46.2	.20,* .20*	.....	Fine silky.
672F-2	.....	86,000	120,000	12.0	20.5	.08, .16*	.....	Fine granular.
672F-3	.....	129,500	141,500	12.0	34.0	.04, .20*	.....	Silky.

[1] 60,000 lb. per sq. in. elastic limit required.

Forged steel from Watertown Arsenal smith shop—Continued.

Marks.	Grade.	Elastic limit per sq. in.	Tensile strength per sq. in.	Elongation.	Contraction of area.	Elongation of inch. sections.	Sclero-scope hardness.	Appearance of fracture.
		Lb.	*Lb.*	*Per ct.*	*Per ct.*	*In.*		
674F	2	47,500	93,500	25.0	43.3	0 33,*0.17	.....	Silky, trace of granulation.
685F	3	61,000	92,000	26.0	43.3	.22, .30*	.....	Do.
690F	3	70,500	114,000	17.5	30.7	.23,* .12	.....	Do.
695F	3	51,000	95,500	24.5	40.3	.29,* .20	.....	Do.
769F	2	53,500	90,500	27.5	49.1	.32,* .23	.....	Do.
771F	3	39,000	80,500	26.0	43.3	.35,* .21	.....	Do.
771F-2	.....	63,000	101,500	20.0	37.1	.28,* .12	.....	Dull silky; trace of granulation.
772F	3	65,500	115,500	10.5	13.2	.08, .13*	.....	Granular.
772F-2	.....	39,000	96,500	14.5	16.9	.14, .15*	.....	Granular; silky spot at circumference.
772F-3	.....	69,500	116,500	18.0	34.0	.25,* .11	37.0	Fine granular; silky center.
773F	D	88,000	123,500	19.5	40.3	.13, .26*	.....	Silky.
773F-2	.....	.....	71,500	.0	.0	.0, .0	.....	Lamellar.
773F-3	.....	127,000	141,500	12.0	37.1	.04, .20*	44.0	Dull silky.
777F	D	95,500	119,000	11.5	27.4	.19,* .04	.....	Silky.
777F-2	.....	104,000	124,000	9.5	13.2	.13,* .06	.....	Lamellar, 90 per cent; granular, 10 per cent.
777F-3	.....	120,000	139,000	7.0	13.2	.03, .11*	47.0	Lamellar.
777F-4	.....	76,000	95,500	3.0	1.8	.02, .04	35.0	Fine granular.
777F-5	.....	134,000	151,500	14.0	40.3	.22,* .05	.....	Silky.
780F	D	78,500	115,500	11.0	13.2	.13,* .09	.....	Amorphous.
780F-2	.....	97,500	129,500	9.0	9.5	.06, .12*	.....	Lamellar, 50 per cent; granular, 50 per cent.
780F-3	.....	.....	83,000	.5	1.8	.01, .00	47.0	Hard granular.
783F	3	64,000	112,500	20.5	37.1	.28,* .13	.....	Silky.
785	2	55,500	86,500	27.5	46.2	.33,* .22	.....	Do.
785A	2	48,500	92,000	24.5	43.3	.35,* .14	.....	Do.
788F	3	56,000	111,500	17.5	34.0	.11, .24*	36.0	Granular, 60 per cent; silky, 40 per cent.
791F	3	58,500	112,000	18.0	37.1	.26,* .10	36.0	Dull silky.
793F	3	61,000	107,500	22.0	37.1	.16, .28*	30.5	Silky.
799F	2	49,500	82,000	28.0	54.6	.18, .38*	25.0	Do.
810F	3	61,500	119,000	13.5	30.7	.20,* .07	34.0	Fine granular; silky center.
810F-2	.....	54,500	110,500	17.5	30.7	.19,* .16*	32.5	Dull silky; trace of granulation.
829F	B	76,000	106,500	23.0	49.1	.28,* .18	.....	Silky; cup shaped.
842F	.....	88,000	118,000	18.5	59.8	.32,* .05	35.0	Fine silky; cup shaped.
880F	B	135,500	135,500	18.5	49.1	.10, .27*	.....	Silky.
880F-2	.....	59,500	98,500	23.0	49.1	.14, .32*	30.0	Silky; cup shaped.
903F	2	40,500	62,500	38.5	66.9	.34, .43*	19.0	Fine silky.
903F-2	.....	42,000	64,500	34.0	64.6	.20, .48*	21.0	Silky.
911F	3	66,000	110,500	20.5	40.3	.13, .28*	30.0	Do.
914F	2,3	51,500	90,500	5.0	5.7	.05,* .05	31.0	Granular.
914F-2	.....	74,000	115,000	11.5	24.0	.06, .17*	35.0	Fine granular, 85 per cent; silky, 15 per cent.
914F-3	.....	61,000	95,500	24.5	43.3	.15, .34*	27.5	Silky.
924F	3	33,500	76,000	28.0	40.3	.25, .31*	24.0	Do.
924F-2	.....	58,500	101,500	18.5	37.1	.26,* .11	31.0	Do.
925F	C	64,500	113,000	14.0	16.9	.14, .14*	33.0	Granular; silky spot at circumference.
925F-2	.....	84,500	117,500	16.5	30.7	.12, .21*	37.0	Silky.
926F	1	39,500	69,000	15.5	30.7	.09, .22*	.....	Silky, with pipe at center.
926F-2	.....	44,500	74,000	30.0	54.6	.41,* .19	24.0	Silky.
930F	3	58,000	108,000	16.5	30.7	.24,* .09	31.0	Dull silky; trace of granulation.
934F	A	61,500	107,500	22.0	43.3	.19, .25*	33.0	Silky.
944F	3	45,000	87,500	21.5	34.0	.28,* .15	27.0	Dull silky; trace of granulation.
944F-2	.....	47,500	98,500	17.5	24.0	.22,* .13	30.0	Do.
957F	3	48,000	96,000	21.5	34.0	.25,* .18	30.0	Do.
959F	2	42,500	79,000	27.5	49.1	.40,* .15	25.0	Silky.
963F	3	44,500	89,500	18.5	49.1	.31,* .06	28.0	Do.
963F-2	.....	57,500	101,500	23.0	40.3	.22,* .24*	28.5	Do.
1004F	3	52,000	100,500	20.5	43.3	.10, .31*	28.0	Dull silky.
1009F	3	64,000	99,500	24.0	43.3	.15, .33*	30.0	Silky.
1019F	C	97,000	122,500	17.5	43.3	.12, .23*	39.0	Do.
1020F	2	57,500	78,500	28.0	62.2	.14, .42*	32.0	Silky; cup shaped.
1037F	3	49,500	82,500	28.0	49.1	.19, .37*	29.0	Silky; seam running lengthwise of specimen.

Forged steel from Watertown Arsenal smith shop—Continued.

Marks.	Grade.	Elastic limit per sq. in.	Tensile strength per sq. in.	Elongation.	Contraction of area.	Elongation of inch. sections.	Scleroscope hardness.	Appearance of fracture.
		Lb.	*Lb.*	*Per ct.*	*Per ct.*	*In.*		
1037 F-2	.....	54,000	88,000	26.0	46.2	.15, .37*	29.0	Silky.
1037 F-3	.....	71,000	112,500	18.0	40.3	.14, .22*	37.5	Do.
1058 F	3	53,000	91,500	22.5	37.1	.30*, .15	28.0	Fine silky; seam one-half depth of specimen opened up full length.
1063 F	2	47,500	76,500	32.0	59.8	0.40,*0.24	24.5	Fine silky.
1071 F	A, B, C, D	136,000	163,500	1.5	.....	.01, .02	53.0	Fine granular.
1071 F-2	.....	129,500	149,000	11.5	40.3	.21,* .02	45.0	Silky; cup shaped.
1071 F-3	.....	123,500	145,500	10.0	34.0	.17,* .03	46.0	Do.
1071 F-4	.....	111,500	129,500	14.0	49.1	.24,* .04	43.5	Do.
1071 F	A, B	96,500	119,000	18.5	51.9	.10, .07	39.0	Fine silky.
1099 F	2	54,500	81,000	29.5	54.6	.19, .40*	25.0	Silky; cup shaped.
1108 F	2	48,500	79,500	30.0	49.1	.28, .32*	24.5	Fine silky.
1134 F	3	54,500	90,500	30.0	54.6	.24, .36*	27.5	Do.
1137 F	3	46,500	79,000	32.0	59.8	.41,* .23	25.0	Do.
1145 F	3	41,000	81,000	14.5	20.5	.19,* .10	29.0	Fine granular.
1145 F-2	.....	48,500	93,000	20.0	27.4	.25,* .15	32.0	Silky; granular spots.
1171 F	Nickel	76,500	109,500	19.5	46.2	.30,* .09	38.0	Silky.
1171 F-2	.....	75,500	105,000	23.5	49.1	.20, .27*	37.0	Do.
1172 FT	Nickel	75,000	105,000	11.0	13.2	.15,* .07	34.0	Fine granular.
1172 FT-2T	.....	76,500	106,000	10.0	9.5	.12,* .08	30.0	Do.
1172 FT-3T	.....	75,000	102,500	13.5	16.9	.12, .15*	32.0	Silky.
1172 FT-4T	.....	74,000	102,500	11.5	13.2	.14,* .09	31.0	Do.
1172 FT-5T	.....	70,000	87,500	6.0	5.7	.05, .07*	30.0	Fine granular; silky streaks.
1172 FT-6T	.....	59,000	90,000	8.0	9.5	.07, .09*	31.0	Lamellar, amorphous.
1172 FT-7T	.....	73,500	101,000	25.5	46.2	.33,* .18	34.5	Fine silky.
1172 FT-8T	.....	63,000	101,500	26.0	49.1	.19, .33*	33.0	Do.
1172 FT-9T	.....	74,500	102,000	23.5	49.1	.15, .32	35.0	Do.
1173 FT	Nickel	76,000	105,500	19.5	37.1	.13, .26*	38.0	Silky.
1173 F-2T	.....	77,000	103,000	24.0	57.2	.35,* .13	33.0	Silky, serrated.
1174 F	3	59,500	96,000	18.5	46.2	.08, .29*	32.0	Fine silky.
1176 F	C	81,000	109,500	22.5	57.2	.34,* .11	36.0	Silky, serrated.
1179 F	3	78,500	124,000	17.5	37.1	.15, .20*	40.0	Dull silky.
1187 F	3	30,500	62,500	15.5	16.9	.12, .19*	21.5	Dull silky; smooth spot.
1189 F	3	46,000	99,500	23.5	40.3	.31,* .16	29.0	Granular, 60 per cent; amorphous, 40 per cent.
1190 F	3	50,500	85,000	27.0	37.1	.26,* .28*	30.0	Dull silky.
1190 F-2	.....	49,500	95,000	23.0	40.3	.32,* .14	29.0	Do.
1195 F	3	77,500	121,000	14.0	20.5	.12, .16*	40.5	Granular; silky spot in center.
1195 F-2	.....	74,500	112,500	20.5	54.6	.08, .33*	37.0	Fine silky.
1196 F	3	50,000	100,000	22.0	37.1	.30,* .14	30.0	Dull silky; granular spots.
1198 F	3	50,000	103,500	16.0	20.5	.21*, .11	32.0	Granular, 90 per cent; amorphous, 10 per cent, with smooth spot.
1198 F-2	.....	50,500	103,000	18.5	34.0	.11, .26*	33.0	Dull silky, 90 per cent; granular, 10 per cent.
1200 F	3	63,000	98,500	27.0	51.9	.34,* .20	30.5	Fine silky.
1202 F	D	107,500	139,000	14.5	34.0	.21,* .18	45.0	Dull silky.
1212 F	3	58,500	105,500	20.0	37.1	.13, .27*	35.0	Silky.
1212 F-2	.....	62,000	111,000	20.5	40.3	.13, .28*	35.0	Do.
1214 F	.....	56,000	98,500	20.0	40.3	.11, .29*	32.0	Dull silky.
1215 F	3	46,500	99,500	14.5	20.5	.16,* .13	34.0	Granular, 90 per cent; silky, 10 per cent.
1215 F-2	.....	44,500	96,500	18.0	30.7	.11, .25*	30.5	Granular, 20 per cent; dull silky, 80 per cent.
1217 F	3	46,000	83,000	26.0	54.6	.40,* .12	27.0	Fine silky.
1217 F-2	.....	41,500	87,000	24.0	37.1	.26,* .22*	27.0	Dull silky.
1217 F-3	.....	44,500	85,500	21.5	34.0	.14, .29*	26.0	Silky.
1217 F-4	.....	42,000	85,500	24.0	34.0	.18, .30*	27.0	Dull silky; trace of granulation.
1217 F-5	.....	68,000	108,500	17.5	37.1	.22, .13	35.0	Dull silky, 90 per cent; granular, 10 per cent.
1221 F	.....	107,000	141,000	14.0	51.9	.04, .24*	45.0	Fine silky; cup shaped.
1222 F	3	58,500	97,500	23.0	43.3	.18, .28*	30.0	Dull silky.
1223 F	2	49,000	77,500	31.0	57.2	.18, .44*	29.0	Do.
1231 F	3	54,500	104,000	21.0	51.9	.21,* .21*	33.0	Silky.

Forged steel from Watertown Arsenal smith shop—Continued.

Marks.	Grade.	Elastic limit per sq. in.	Tensile strength per sq. in.	Elongation.	Contraction of area.	Elongation of inch. sections.	Sclero-scope hardness.	Appearance of fracture.
		Lb.	*Lb.*	*Per ct.*	*Per ct.*	*In.*		
1241 F	3	41,500	76,000	32.0	59.8	0.45,*0.19	32.0	Silky; cup shaped.
1241 F-2	.....	57,000	96,000	24.5	57.2	.36,* .13	30.0	Silky.
1249 F	3	62,500	107,000	23.0	43.3	.22, .24*	32.5	Do.
1250 F	3	62,000	108,000	22.0	46.2	.30,* .14	32.0	Dull silky.
1275 F	3	48,500	101,500	19.5	34.0	.17, .22*	33.0	Granular, 45 per cent; amorphous, 55 per cent.
1283 F	3	42,500	78,000	30.0	46.2	.23, .37*	25.0	Silky.
1283 F-2	.....	58,000	99,500	23.5	43.3	.28,* .19	34.0	Dull silky.
1290 F	3	49,000	75,000	28.0	57.2	.41,* .15	31.0	Silky.
1290 F-2	.....	51,500	74,500	31.0	51.9	.48,* .12	29.0	Do.
1290 F-3	.....	58,500	102,500	22.5	43.3	.19, .26*	31.0	Do.
1290 F-4	.....	59,000	97,000	25.0	49.1	.16, .34*	29.0	Fine silky; cup shaped.
1308 F	D	88,000	121,500	17.5	40.3	.09, .26*	41.0	Do.
1308 F-2	D	86,500	114,000	17.0	43.3	.07, .27*	39.0	Fine silky, serrated.
1308 F-3	D	108,500	128,000	9.0	13.2	.12,* .06	35.0	Silky oblique.
1308 F-4	D	93,500	120,000	7.0	9.5	.10,* .04	43.0	Fine granular.
1308 F-5	D	122,500	145,500	15.5	40.3	.14,* .17*	45.0	Fine silky.
1309 F	D	74,000	103,500	23.5	43.3	.15, .34	31.0	Do.
1309 F-2	D	92,000	119,500	20.0	49.1	.30,* .10	38.0	Fine silky, serrated.
1309 F-3	D	122,500	158,000	10.0	27.4	.14,* .06	52.0	Fine granular, 85 per cent; silky, 15 per cent.
1309 F-4	D	96,500	133,500	13.5	37.1	.22, .05	39.0	Fine granular.
1309 F-5	D	136,500	158,500	13.5	37.1	.21,* .06	51.0	Silky.
1309 F-6	D	104,500	128,000	8.0	13.2	.06, .10*	39.0	Silky oblique.
1309 F-7	D	146,500	161,500	10.0	27.4	.15,* .05	53.0	Silky.
1309 F-8	D	125,000	145,500	15.0	40.3	.22,* .08	46.0	Do.
1316 F	3	50,500	91,000	23.5	34.0	.23,* .24*	29.0	Do.
1336 F	3	69,000	100,000	23.5	51.9	.33,* .14	29.5	Fine silky; cup shaped.
1349 F [1]	.....	102,500	124,000	18.5	54.6	.07, .30	42.0	Fine silky; serrated.
1354 F	D	123,500	136,500	16.5	43.3	.26,* .07	46.0	Do.
1363 F	2	56,000	82,000	29.5	51.9	.40,* .19	37.0	Fine silky; cup shaped.
1387 F	3	55,500	101,500	15.0	20.5	.14, .16*	33.0	Coarse granular, with silky spot.
1387 F-2	3	50,500	83,500	27.0	59.8	.40,* .14	31.0	Fine silky; cup shaped.
1387 F-3	3	49,000	90,000	24.5	34.0	.28,* .21	28.0	Silky.
1397 F	2	56,000	84,000	29.0	54.6	.17, .41*	33.0	Fine silky.
1405 F	3	48,500	97,000	24.5	37.1	.25,* .24*	26.5	Fine granular; silky center.
1437 F	3	47,500	90,500	24.0	37.1	.20, .28*	33.0	Dull silky.
1448 F	2	56,000	84,000	30.5	54.6	.27, .34*	32.0	Silky.
1458 F	3	53,500	92,500	16.0	51.9	.05, .27*	31.0	Fine silky; cup shaped.
1466 F	D	91,000	119,500	19.5	49.1	.09, .30*	38.0	Fine silky.
1466 F-2	D	125,500	151,000	14.0	37.1	.20, .08	50.0	Silky; cup shaped.
1554 F	2	51,000	84,000	28.0	34.6	.39, .17	27.0	Silky.
1562 F	2	50,000	85,000	28.0	54.6	.17, .39	32.0	Fine silky; cup shaped.
7 F	3	54,000	109,000	8.5	9.5	.11, .06	32.0	Granular.
7 F-2	3	49,500	94,500	22.0	34.0	.20, .24*	28.0	Dull silky; trace of granulation.
8 F	3	54,000	85,500	27.0	54.6	.15, .39*	25.0	Silky.
19 F-2	3	53,500	89,500	27.5	54.6	.22, .33*	26.0	Fine silky; cup shaped.
35 F	2	80,000	117,500	19.5	43.3	.29,* .10	34.0	Silky.
51 F-2	3	45,000	74,000	17.0	20.5	.24, .10	27.0	Silky, open crack through stem extending half the length.
61 F-3	3	58,500	85,500	18.5	40.3	.11, .26*	33.0	Silky, pipe at center.
51 F-4	3	65,500	119,000	16.5	34.0	.09, .24*	33.0	Silky.
63 F	2	49,000	82,500	28.0	51.9	.19, .37*	23.0	Do.
71 F	3	43,000	59,500	36.5	66.9	.27, .46*	21.0	Fine silky.
76 F	2	49,000	80,500	30.0	57.2	.33,* .27	25.0	Do.
84 F	3	45,500	77,000	33.0	57.2	.24, .42*	24.0	Do.
92 F	3	68,500	112,500	22.5	49.1	.12, .33*	36.0	Silky.
134 F	A	49,000	93,500	24.5	37.1	.26,* .23	29.0	Do.
134 F-2	A	79,000	123,000	18.0	30.7	.22,* .14	38.0	Fine granular; silky center.
156 F	3	46,500	81,500	28.0	46.2	.29,* .27*	25.0	Silky.
156 F-2	3	55,000	89,500	28.0	66.9	.13, .43*	32.0	Fine silky.
156 F-3	3	64,500	106,000	19.5	43.3	.17, .22*	33.0	Dull silky, 90 per cent; fine granular, 10 per cent.

Forged steel from Watertown Arsenal smith shop—Continued.

Marks.	Grade.	Elastic limit per sq. in.	Tensile strength per sq. in.	Elongation.	Contraction of area.	Elongation of inch. sections.	Sclero-scope hardness.	Appearance of fracture.
		Lb.	*Lb.*	*Per ct.*	*Perct.*	*In.*		
161 F	2	40,500	72,500	32.0	64.6	.17, .47*	23.0	Fine silky; cup shaped.
161 F-2	2	59,500	103,000	19.0	43.3	.08, .30*	36.0	Silky; trace of granulation.
165 F	3	77,000	108,000	22.5	59.8	.12, .33*	35.0	Fine silky; serrated.
167 F	2	49,000	79,500	31.5	57.2	.23, .40*	24.0	Fine silky.
170 F	2	45,000	93,500	22.0	34.0	.28,* .16	29.5	Silky; trace of granulation.
173 F	3	49,000	97,500	19.5	30.7	.13, .26*	31.0	Dull silky, 85 per cent; fine granular, 15 per cent.
174 F	2	41,500	86,000	20.0	27.4	.23,* .17	28.0	Silky.
176 F	2	45,500	86,500	27.5	49.1	.21, .34*	28.0	Do.
178 F	B	62,000	112,000	18.0	37.1	.26,* .10	31.0	Dull silky.
178 F-2	B	79,500	120,500	17.5	46.2	.27,* .08	36.0	Silky; cup shaped.
188 F	.....	59,500	90,000	27.0	59.8	.40,* .14	31.0	Fine silky; cup shaped.
193 F	2	57,000	89,000	29.0	57.2	.18, .30*	32.0	Fine silky.
197 F	3	48,500	97,500	18.5	34.0	.26,* .11	30.0	Silky, 90 per cent; granular, 10 per cent.
198 F[1]	.....	47,500	81,500	22.0	46.2	.31,* .13	25.0	Fine silky.
198 F-2[1]	.....	56,000	93,000	22.0	40.3	.26,* .18	30.0	Silky.
198 F-3[1]	.....	63,000	113,000	18.5	37.1	.10, .27*	33.0	Do.
199 F	3	43,000	76,500	26.0	49.1	.28*, .24	25.5	Fine silky.
199 F-2	3	58,500	103,500	22.5	43.3	.27,* .18	30.0	Do.
207 F	3	52,500	102,500	19.5	30.7	.23,* .16	29.0	Fine granular; silky center.
221 F	2	56,500	105,500	19.5	34.0	.27,* .12	31.0	Granular, 70 per cent; dull silky, 30 per cent.
276 F	D	118,000	175,500	10.5	24.0	.05, .16*	54.0	Fine granular; silky center.
277 F	3	55,500	86,000	27.0	51.9	.16, .38*	24.0	Silky.
278 F	3	50,500	105,500	13.5	16.9	.10, .17*	30.0	Granular, with silky spot at circumference.
278 F-2	3	50,500	96,000	24.0	40.3	.18, .30*	30.0	Silky.
279 F	3	59,000	101,500	22.0	43.3	.22,* .22*	28.0	Silky; trace of granulation.
319 F	1	39,000	73,500	29.5	57.2	.43,* .16	24.0	Fine silky.
327 F	2	51,000	83,500	28.0	49.1	.17, .39*	24.0	Do.
341 F	2	51,500	83,000	23.5	49.1	.12, .35*	26.0	Do.
357 F	3	53,500	85,000	28.0	54.6	.40,* .16	26.0	Do.
357 F-2	3	43,500	94,000	21.0	34.0	.15, .27*	28.0	Silky; trace of granulation.
378 F	D	95,000	124,500	17.5	43.3	.26*, .09	38.0	Silky.
378 F-2	D	116,500	139,000	15.0	37.1	.22,* .08	32.0	Do.
394 F	3	41,000	80,500	26.5	43.3	.30,* .23*	26.5	Do.
394 F-2	3	76,000	106,000	22.0	49.1	.11, .33*	32.0	Fine silky; cup shaped.
398 F	2	59,500	89,500	23.5	57.2	.40,* .07	25.0	Fine silky.
427 F	B	67,500	98,500	23.0	46.2	.14, .32*	30.0	Silky.
432 F	B	66,500	105,000	24.0	49.1	.19, .29*	30.0	Do.
445 F	2	76,000	97,500	24.5	51.9	.27, .22	29.0	Silky; cup shaped.
448 F	3	56,000	87,000	29.5	51.9	.20, .39*	26.0	Silky.
448 F-2	3	56,000	87,500	28.5	51.9	.26,* .31*	26.0	Fine silky.
476 F	3	39,000	86,000	26.0	43.3	.27,* .25*	27.5	Fine granular, 70 per cent silky; 30 per cent.
479 F	3	44,000	90,000	23.5	37.1	.17, .30*	27.0	Dull silky; trace of granulation.
505 F	3	65,000	99,000	23.0	37.1	.15, .31*	30.0	Dull silky, 50 per cent; fine granular, 50 per cent.
517 F	A	46,000	89,000	24.5	49.1	.12, .37*	30.0	Silky.
525 F	3	56,000	94,500	27.0	49.1	.20, .34*	30.0	Fine silky.

[1] 60,000 lb. per sq. in. elastic limit required.

Forged steel from Watertown Arsenal smith shop—Continued.

EXPERIMENTAL TESTS FOR STUDENT OFFICERS.

Marks.	Elastic limit per sq. in.	Tensile strength per sq. in.	Elongation in 2 in.	Contraction of area.	Elongation of inch sections.	Sclero-scope hardness.	Appearance of fracture.
	Lb.	*Lb.*	*P. ct.*	*P. ct.*	*In.*		
W.H.M. A-1...	54,500	95,500	20.0	34.0	0.11, 0.29*	.....	Silky.
W.H.M. A-2...	57,000	96,500	24.5	43.3	.24,* .25*	.....	Do.
W.H.M. A-3...	52,000	93,000	19.5	30.7	.14, .25*	.....	Do.
W.H.M. A-4...	53,500	93,000	24.5	40.3	.31,* .18	.....	Do.
W.H.M. B-1...	42,000	86,000	23.0	37.1	.28,* .18	.....	Do.
W.H.M. B-2...	42,000	86,000	22.5	37.1	.30,* .15	.....	Do.
W.H.M. B-3...	42,000	86,500	24.0	37.1	.17, .31*	.....	Do.
W.H.M. B-4...	40,500	83,500	23.5	37.1	.31,* .16	.....	Do.
W.H.M. C-1...	55,500	96,500	12.0	49.1	.11, .13*	.....	Fine silky.
W.H.M. C-2...	52,500	94,000	19.5	51.9	.08, .31*	.....	Do.
W.H.M. C-3...	57,500	100,000	18.5	37.1	.10, .27*	.....	Do.
W.H.M. C-4...	51,500	91,500	23.5	49.1	.12, .35*	.....	Do.
W.H.M. E-1...	64,000	98,000	20.5	54.6	.08, .33	.....	Silky.
W.H.M. E-2...	67,000	99,500	18.5	57.2	.31,* .06	.....	Silky, serrated.
W.H.M. E-3...	71,000	111,500	18.5	40.3	.27,* .10	.....	Fine granular; silky center.
W.H.M. E-4...	52,500	85,000	18.5	54.6	.04, .33*	.....	Silky; cup shaped.
W.H.M. F-1...	64,500	96,000	20.0	57.2	.08, .32*	.....	Silky.
W.H.M. F-2...	58,500	88,500	16.0	49.1	.06, .26*	.....	Silky; opened seam at stem.
W.H.M. F-3...	65,500	108,000	21.5	46.2	.31,* .12	.....	Silky.
W.H.M. F-4...	62,500	95,500	15.5	57.2	.26,* .05	.....	Silky, serrated.
W.H.M. G-1...	48,500	87,500	27.5	43.3	.39,* .16	.....	Silky.
W.H.M. G-2...	51,000	86,000	27.5	51.9	.16, .39*	.....	Do.
W.H.M. G-3...	52,000	87,500	29.5	49.1	.24, .35*	.....	Do.
W.H.M. G-4...	49,500	84,500	28.0	51.9	.28,* .28*	.....	Do.
W.H.M. H-1...	48,500	89,500	22.5	40.3	.13, .32*	.....	Do.
W.H.M. H-2...	42,500	84,500	25.0	40.3	.19, .31*	.....	Do.
W.H.M. H-3...	43,500	81,500	27.0	43.3	.19, .35*	.....	Do.
W.H.M. H-4...	46,500	90,000	25.0	40.3	.18, .32*	.....	Do.
M.H.W. A-1...	50,000	75,500	27.5	49.1	.28,* .27	.....	Do.
M.H.W. A-2...	44,500	76,500	27.0	43.3	.26, .28*	.....	Do.
M.H.W. A-3...	45,000	74,500	27.0	46.2	.38,* .16	.....	Do.
M.H.W. A-4...	42,500	74,000	30.5	57.2	.41,* .20	.....	Do.
M.H.W. A-5...	45,500	76,000	25.5	34.0	.31,* .20	.....	Silky, with granular spots near circumference.
M.H.W. A-6...	52,500	78,000	28.5	54.6	.17, .40*	.....	Silky; cup shaped.
M.H.W. B-1...	40,500	75,000	31.5	54.6	.35,* .28	.....	Silky.
M.H.W. B-2...	47,000	78,500	30.0	40.3	.24, .36*	.....	Do.
M.H.W. B-3...	48,500	76,500	30.5	54.6	.42,* .19*	.....	Do.
M.H.W. B-4...	49,500	75,500	30.0	54.6	.19, .41	.....	Do.
M.H.W. B-5...	47,000	76,500	28.0	51.9	.21, .35*	.....	Do.
M.H.W. B-6...	50,000	78,000	32.0	54.6	.21, .43*	.....	Do.
M.H.W. C-1...	56,500	92,000	23.5	51.9	.16, .31*	.....	Do.
M.H.W. C-2...	55,600	92,900	22.0	45.4	.12, .32*	.....	Do.
M.H.W. C-3...	52,000	88,000	23.5	46.2	.16, .31*	.....	Do.
M.H.W. C-4...	54,000	89,500	23.0	40.3	.16, .30*	.....	Silky, oblique.
M.H.W. C-5...	52,000	88,000	23.5	46.2	.14, .33*	.....	Silky.
M.H.W. C-6...	58,500	94,000	23.0	46.2	.14, .32*	.....	Do.
M.H.W. D-1...	44,500	73,000	28.0	59.8	.45,* .11	.....	Do.
M.H.W. D-2...	58,500	93,000	23.5	51.9	.21, .26*	.....	Do.
M.H.W. D-3...	55,500	84,000	28.5	62.2	.20, .37*	.....	Silky; cup shaped.
M.H.W. D-4...	51,500	82,000	24.5	62.2	.39,* .10	.....	Silky.
M.H.W. D-5...	58,500	92,500	25.0	57.2	.17, .33*	.....	Do.
M.H.W. D-6...	52,000	83,500	28.5	62.2	.43,* .14	.....	Do.
M.H.W. E-1...	66,000	101,000	20.5	57.2	.10, .31*	.....	Do.
M.H.W. E-2...	64,500	105,500	18.0	49.1	.09, .27*	.....	Do.
M.H.W. E-3...	62,500	98,500	20.0	51.9	.30,* .10	.....	Do.
M.H.W. E-4...	70,000	104,000	20.0	54.6	.31,* .09	.....	Do.
M.H.W. E-5...	67,000	100,500	18.0	49.1	.08, .28*	.....	Do.
M.H.W. E-6...	60,000	100,500	21.0	51.9	.32,* .10	.....	Do.
M.H.W. F-1...	55,000	83,500	27.5	64.6	.42,* .13	.....	Fine silky.
M.H.W. F-2...	47,500	74,500	26.5	57.2	.40,* .13	.....	Do.
M.H.W. F-3...	43,000	71,500	34.5	57.2	.25, .44*	.....	Do.
M.H.W. F-4...	44,500	71,500	35.5	57.2	.45,* .26	.....	Do.
M.H.W. F-5...	45,500	73,000	32.0	57.2	.26, .38*	.....	Do.
M.H.W. F-6...	46,500	72,500	34.0	57.2	.23, .45*	.....	Do.
A-1.....	57,500	93,000	13.5	16.9	.12, .15*	26.0	Silky, with light colored spots.
A-2.....	45,000	83,500	25.5	37.1	.26,* .25*	25.0	Fine granular, 50 per cent; amorphous, 50 per cent.
A-3.....	63,000	107,500	19.0	43.3	.29,* .09	37.0	Silky.
A-4.....	80,000	120,500	17.0	37.1	.16, .18*	38.0	Fine granular, 50 per cent; silky, 50 per cent.
A-5.....	71,500	111,500	16.5	34.0	.10, .23*	36.0	Fine granular, 45 per cent; dull silky, 55 per cent.
A-6.....	60,000	102,000	18.5	43.3	.10, .27*	30.0	Dull silky.
A-7.....	53,500	92,500	24.5	49.1	.36,* .13	32.0	Silky.

Forged steel from Watertown Arsenal smith shop—Continued.

EXPERIMENTAL TESTS FOR STUDENT OFFICERS—Continued.

Marks.	Elastic limit per sq. in.	Tensile strength per sq. in.	Elongation in 2 in.	Contraction of area.	Elongation of inch sections.	Scleroscope hardness.	Appearance of fracture.
	Lb.	*Lb.*	*P. ct.*	*P. ct.*	*In.*		
A-8	46,000	86,500	23.5	37.1	0.23, *0.24*	30.0	Dull silky.
B-1	60,500	93,000	25.5	37.1	.21, .30*	28.0	Silky.
B-2	41,500	83,000	24.0	34.0	.20, .28*	25.0	Fine granular, 60 per cent; amorphous, 40 per cent.
B-3	62,000	108,000	19.0	46.2	.29,* .09	37.0	Silky.
B-4	85,500	124,500	15.0	34.0	.09, .21*	37.0	Fine granular, 20 per cent; silky, 80 per cent.
B-5	74,000	117,500	16.5	37.1	.23,* .10	38.0	Fine granular, 75 per cent; dull silky, 25 per cent in center.
B-6	65,000	105,000	23.0	46.2	.27,* .19	33.0	Dull silky.
B-7	56,000	93,000	25.5	43.3	.16, .35*	33.5	Silky.
B-8	46,000	87,000	24.5	37.1	.18, .31*	30.0	Dull silky.
B-9	.....	102,000	0.0	0.0	.00, .00	81.0	Fine granular.
C-1	52,000	91,000	14.5	20.5	.13, .16*	26.0	Silky, with light colored spot at circumference.
C-2	43,000	83,000	23.0	34.0	.30,* .16	24.0	Fine granular, 60 per cent; amorphous, 40 per cent.
C-3	58,500	102,000	21.0	43.3	.29,* .13	35.0	Silky.
C-4	76,500	122,000	15.0	27.4	.10, .20*	38.0	Fine granular, 60 per cent; silky, 40 per cent.
C-5	65,500	109,000	16.5	34.0	.21,* .12	34.0	Fine granular, 75 per cent; dull silky, 25 per cent.
C-6	69,000	109,000	21.0	49.1	.10, .32*	35.0	Dull silky.
C-7	57,000	92,000	27.5	49.1	.34,* .19	33.0	Silky.
C-8	50,500	84,000	24.5	43.3	.15, .34*	31.0	Dull silky.
D-1	52,000	93,000	20.5	30.7	.13, .28*	27.0	Silky.
D-2	46,000	80,500	26.0	46.2	.16, .36*	24.0	Amorphous.
D-3	65,500	110,500	18.5	43.3	.27,* .10	37.0	Silky.
D-4	73,500	118,000	18.0	40.3	.10, .26*	36.0	Dull silky.
D-5	85,000	128,000	15.0	34.0	.18,* .12	40.5	Fine granular, 85 per cent; dull silky, 15 per cent.
D-6	65,000	106,000	27.0	49.1	.17, .37*	34.0	Dull silky.
D-7	53,500	93,500	25.0	46.2	.33,* .17	32.5	Silky.
D-8	45,500	86,000	24.0	37.1	.30,* .18	31.0	Dull silky.
E-2	42,000	80,500	15.5	16.9	.14, .17*	24.0	Fine granular; amorphous spot near circumference.
E-3	56,000	94,500	22.0	30.7	.26,* .18	33.0	Silky.
E-4	68,000	103,500	9.5	16.9	.07, .12*	28.0	Dull silky, granular spots.
E-5	71,500	115,500	9.0	13.2	.10,* .08	37.5	Granular, silky spot in center.
E-6	68,000	110,000	19.0	37.1	.22,* .16	35.5	Dull silky.
E-7	56,500	88,500	16.5	24.0	.19,* .14	29.5	Do.
E-8	44,500	85,500	18.5	34.0	.17, .20*	30.0	Dull silky, with granular spots.
1-L	58,000	91,000	27.0	46.2	.17, .37*	32.5	Silky.
1-M	57,500	91,000	27.0	43.3	.19, .35*	32.5	Do.
1-R	56,000	91,500	26.5	43.3	.32,* .21	32.5	Do.
L	54,500	89,500	27.0	51.9	.38,* .16	26.0	Do.
L	54,000	91,500	27.0	49.1	.18, .36*	27.0	Do.
L	52,500	90,000	26.0	49.1	.36,* .16	27.0	Do.
R-3	76,000	106,500	4.5	5.7	.06,* .03	40.0	Fine granular; seam at circumference.
R-3	72,000	114,000	18.0	37.1	.10, .26*	37.0	Silky.
R-3	69,000	113,000	17.5	40.3	.12, .23*	38.0	Do.
R-4	43,500	94,000	19.5	34.0	.26,* .13	29.0	Dull silky.
R-4	44,000	93,500	21.0	34.0	.20,* .22*	29.0	Dull silky; trace of granulation.
R-4	43,000	94,000	20.5	34.0	.13, .28*	30.0	Do.
R-5	62,500	101,000	15.5	46.2	.25,* .06	33.0	Silky.
R-5	66,000	106,000	21.5	46.2	.12, .31*	33.0	Do.
R-5	65,500	107,000	17.0	40.3	.23,* .11	32.0	Fine granular, 65 per cent; silky, 35 per cent.
R-6	46,500	82,000	10.0	16.9	.12,* .08	25.0	Silky.
R-6	44,000	82,000	10.5	16.9	.13,* .08	25.0	Do.
R-6	42,500	75,500	7.5	9.5	.09,* .06	25.0	Fine granular, 60 per cent; amorphous, 40 per cent.
R-7	49,500	86,500	11.5	13.2	.11, .12*	27.0	Fine granular.
R-7	48,000	82,000	10.5	13.2	.11,* .09	26.0	Silky.
R-7	47,500	80,000	8.5	13.2	.10,* .07	26.0	Fine granular, 60 per cent; amorphous, 40 per cent.

BRONZE FOR ORDNANCE WORK.

BRONZE FROM WATERTOWN ARSENAL FOUNDRY.

[The inch in which fracture occurred is marked thus *.]

Marks.	Grade.	Tensile strength per sq. in.	Elongation.	Contraction of area.	Elongation of inch sections.	Scleroscope hardness.	Appearance of fracture.
		Lb.	*Per cent.*	*Per cent.*	*In.*		
10623	3	63,600	11.5	11.6	.13,* .10	.....	Light yellow.
10660	3	63,000	10.0	14.0	.11,* .09	.....	Do.
10667	3	63,400	17.5	18.6	.20,* .15	.....	Do.
10703	3	63,600	18.5	20.8	.21,* .16	.....	Do.
10710	3	54,200	11.0	11.6	.09, .13*	.....	Do.
10718	3	56,200	10.0	14.0	.08, .12*	.....	Do.
10727	3	61,000	16.5	20.5	.15, .18*	.....	Do.
10734	3	60,800	16.5	18.6	.15, .18*	.....	Do.
10742	3	59,000	18.0	20.8	.19,* .17	.....	Do.
10750	3	62,000	15.0	16.3	.13, .17*	.....	Do.
10758	3	61,600	15.5	16.3	.14, .17*	.....	Do.
10766	3	63,200	20.0	20.8	.22,* .18*	.....	Do.
10773	3	63,900	22.0	23.0	.21, .23*	.....	Do.
10782	3	60,000	13.0	14.0	.15,* .11	.....	Do.
10790	3	60,400	14.5	14.0	.11, .18*	.....	Do.
10797	3	59,400	15.5	14.0	.14, .17*	.....	Do.
10810	3	60,200	14.0	16.3	.15,* .13*	.....	Do.
10816	3	59,800	10.0	11.6	.08, .12*	.....	Light yellow and lemon.
10823	3	58,400	10.5	14.0	.10, .11*	.....	Light yellow, lemon spot.
10831	3	64,800	21.0	20.8	.24,* .18	.....	Light yellow.
10839	3	61,400	18.0	20.8	.22,* .14	.....	Do.
10846	3	65,800	23.0	23.0	.27,* .19	.....	Do.
10863	4	63,400	39.0	33.6	.39,* .39*	.....	Light yellow oblique.
10864	3	55,000	12.0	14.0	.15.* .09	.....	Light yellow and lavender.
10887	4	53,200	14.0	14.0	.11, .17*	.....	Light yellow and lemon.
10906	4	67,600	29.5	29.5	.26, .33*	.....	Light yellow.
10908	4	64,200	38.5	31.6	.41,* .36	.....	Do.
10910	4	63,600	28.5	29.5	.25, .32*	.....	Do.
10915	4	67,200	30.0	27.4	.31,* .29	.....	Do.
10918	3	60,800	11.5	14.0	.10, .13*	.....	Light yellow, coarse granular.
10928	3	48,200	11.0	14.0	.13,* .09	.....	Light yellow and lemon.
10935	3	58,400	14.0	14.0	.13, .15*	.....	Light yellow, lavender, and lemon.
10940	3	30,000	6.5	6.9	.05, .08*	.....	Dark brown, lavender, and lemon. Defective.
10940-2	3	41,200	11.5	11.6	.15,* .08	.....	Light yellow and lavender.
10947	3	61,600	19.5	20.8	.21,* .18	.....	Light yellow.
10960	3	61,600	16.0	16.3	.18,* .14	.....	Light yellow and lavender.
10965	3	62,200	20.5	20.8	.22,* .19	.....	Do.
10990	3	54,500	8.5	9.3	.06, .11*	.....	Do.
10999	3	57,500	10.0	11.6	.08, .12*	.....	Do.
11011	3	59,800	16.0	18.6	.18,* .14	.....	Do.
11022	3	57,100	13.5	16.3	.15,* .12	.....	Do.
11045	3	59,800	16.0	20.8	.15, .17*	.....	Do.
11056	3	57,800	14.5	18.6	.13, .16*	.....	Do.
11067	3	58,600	17.5	23.0	.19,* .16	.....	Do.
11074	3	62,000	21.0	23.0	.20, .22*	.....	Do.
11089	3	61,000	23.0	24.0	.21, .25*	.....	Do.
11098	3	59,600	16.5	16.3	.16, .17*	.....	Do.
11112	2	32,800	19.5	18.6	.26,* .13	.....	Light yellow and lavender.
11112-2	2	21,400	11.0	9.3	.17,* .05	.....	Dark brown and yellow.
11080	3	61,800	15.5	16.3	.15, .16*	.....	Light yellow.
11106	3	57,000	13.0	14.0	.15,* .11*	.....	Do.
11117	3	56,400	11.5	14.0	.09, .14*	.....	Do.
11123	3	32,200	16.0	20.8	.18,* .14	.....	Yellow and lavender.
11123-2	3	23,800	12.0	6.7	.18,* .06	.....	Brown, red, and yellow.
11124	3	61,400	9.5	9.3	.09, .10*	.....	Light yellow.
11133	2	18,400	3.5	2.0	.01, .06*	.....	Yellow and lavender.
11133-2	2	37,600	40.0	31.6	.48,* .32	.....	Light yellow.
11134	3	63,000	21.5	20.8	.23,* .20	.....	Do.
11140	3	60,000	19.0	23.0	.22,* .16	.....	Do.
11147	2	35,000	27.0	25.2	.25, .29*	.....	Yellow and lavender.
11147-2	2	33,000	22.0	20.8	.25,* .19	.....	Light yellow.
11148	3	58,800	14.5	18.6	.13, .16*	.....	Do.
11162	3	64,000	20.5	20.8	.22,* .19	.....	Do.
11194	3	62,000	20.5	20.8	.18, .23*	.....	Do.
11210	3	62,400	18.0	18.6	.16, .20*	.....	Do.
11219	3	61,200	16.5	18.6	.14, .19*	.....	Do.
11229	3	56,400	17.5	18.6	.15, .20*	.....	Do.

Bronze from Watertown Arsenal foundry—Continued.

Marks.	Grade.	Tensile strength per sq. in.	Elongation.	Contraction of area.	Elongation of inch sections.	Sclero-scope hardness.	Appearance of fracture.
		Lb.	*Per cent.*	*Per cent.*	*In.*		
11257	3	63,200	17.0	16.3	.15, .19*	.....	Light yellow.
11264	3	59,000	15.5	16.3	.13, .18*	.....	Do.
11274	3	62,800	24.0	23.0	.23, .25*	.....	Do.
11294	3	63,800	25.0	25.2	.23, .27*	.....	Do.
11311	3	54,600	9.5	14.0	.06, .13*	.....	Do.
11327	3	56,800	8.5	14.0	.10,* .07	.....	Do.
11336	3	58,600	19.5	18.6	.23,* .16	.....	Do.
11349	3	57,200	12.0	14.0	.14,* .10	.....	Do.
11365	3	50,800	17.0	18.6	.15, .19*	.....	Do.
11370	3	60,200	10.0	14.0	.08, .12*	.....	Do.
11373	3	53,200	9.5	11.6	.07, .12*	.....	Do.
11377	3	57,800	12.5	16.3	.15,* .10	.....	Do.
11393	3	62,000	22.0	20.8	.24,* .20	.....	Do.
11404	3	50,600	18.0	18.6	.14, .22*	.....	Light yellow and lemon yellow.
11408	3	60,400	21.5	25.2	.21, .22*	.....	Light yellow and lavender.
11418	3	58,600	17.5	20.8	.15, .20*	.....	Do.
11434	3	62,400	24.0	25.2	.23, .25*	.....	Light yellow.
11444	3	59,600	15.0	18.6	.16,* .14	.....	Light yellow and lavender.
11454	3	61,800	16.5	20.8	.15, .18*	.....	Light yellow.
11486	3	61,000	15.0	18.6	.17,* .13	.....	Light yellow, with golden yellow spots.
11508	3	52,800	6.0	6.9	.10,* .02	.....	Light yellow and lemon yellow.
11515	3	54,200	8.0	11.6	.06, .10*	.....	Do.
11522	3	63,600	19.0	18.6	.21,* .17	.....	Light yellow.
11531	4	63,600	39.0	30.4	.40,* .38	.....	Light yellow, oblique.
11537	3	63,000	27.0	27.4	.24, .30*	.....	Light yellow.
11544	3	62,600	27.5	25.2	.29,* .26	.....	Do.
11552	3	62,600	26.0	25.2	.25, .27*	.....	Do.
11559	3	42,200	16.5	14.0	.20,* .13	.....	Lavender and lemon yellow.
11559–2	3	40,100	13.5	17.7	.11, .16*	.....	Do.
11567	3	47,800	13.0	11.6	.13,* .13*	.....	Lavender and light yellow.
11573	3	63,800	30.0	27.4	.29, .31*	.....	Light yellow.
11580	3	64,800	34.5	29.5	.38,* .31	.....	Do.
11590	4	64,600	36.5	33.6	.34, .41*	.....	Do.
11593	3	67,200	23.5	33.6	.26,* .21	.....	Do.
11600	3	63,200	22.5	21.9	.21, .24*	.....	Lavender.
11607	3	61,800	31.0	33.6	.36,* .26	.....	Light yellow.
11614	3	65,000	30.5	29.5	.31,* .30	.....	Do.
11619	3	39,800	5.0	4.4	.08,* .02	.....	Lavender and lemon yellow.
11619–2	3	44,000	13.0	11.6	.13,* .13*	.....	Do.
11626	3	53,800	14.0	14.0	.11, .17*	.....	Do.
11633	3	48,600	7.0	9.3	.08,* .06	.....	Do.
11639	3	59,200	12.5	14.0	.15,* .10	.....	Lavender and light yellow.
11645	3	41,400	7.5	9.3	.11,* .04	.....	Lavender and lemon yellow.
11645–2	3	57,800	18.5	11.6	.11, .26*	.....	Do.
11652	3	50,800	6.0	6.7	.05, .07*	.....	Do.
11659	3	59,200	12.5	14.0	.13,* .12	.....	Light yellow.
11665	3	57,800	15.0	16.3	.12, .18*	.....	Do.
11671	3	33,200	5.0	6.7	.03, .07*	.....	Light yellow and lemon yellow.
11671–2	3	45,400	10.0	4.4	.04, .16*	.....	Do.
11678	3	41,800	6.5	6.7	.04, .09*	.....	Do.
11678–2	3	49,000	7.5	6.7	.10,* .05	.....	Do.
11684	3	60,400	20.5	18.6	.17, .24*	.....	Do.
11687	3	61,800	17.0	16.3	.16, .18*	.....	Light yellow.
11704	4	64,200	35.5	33.6	.35,* .36*	.....	Do.
11710	3	63,600	30.0	29.5	.33,* .27	.....	Do.
11716	3	63,400	27.0	27.4	.23, .31*	.....	Do.
11740	3	63,600	33.5	29.5	.37,* .30	.....	Do.
11746	3	41,500	5.5	8.5	.07,* .04	.....	Lavender and lemon yellow.
11746–2	3	42,800	5.5	6.7	.08,* .03	.....	Do.
11753	3	56,600	10.0	9.3	.11,* .09	.....	Do.
11760	3	64,400	19.5	20.8	.21,* .18	.....	Light yellow.
11767	3	61,500	17.0	20.1	.17,* .17*	.....	Light yellow and lavender.
11774	3	45,200	7.0	6.7	.09,* .05	.....	Light yellow and lemon yellow.
11779	3	62,700	28.5	28.7	.25, .32*	.....	Do.
11788	3	59,300	8.5	13.2	.07, .10*	.....	Light yellow and lavender
11796	3	66,200	15.5	17.7	.18,* .13	.....	Do.
11803	3	66,900	20.5	10.8	.23,* .18	.....	Light yellow.
11810	3	61,500	24.5	24.4	.28,* .21	.....	Do.
11817	3	43,100	9.5	10.8	.11,* .08	.....	Lavender and lemon yellow.
11817–2	.....	49,000	12.0	14.0	.13,* .11	.....	Do.
11823	3	56,600	43.0	34.8	.47,* .39	.....	Light yellow.
11827	3	59,200	25.0	24.4	.27,* .23	.....	Do.
11837	4	67,400	31.5	30.7	.35,* .28	.....	Do.

Bronze from Watertown Arsenal foundry—Continued.

Marks.	Grade.	Tensile strength per sq. in.	Elongation.	Contraction of area.	Elongation of inch sections.	Sclero-scope hard-ness.	Appearance of fracture.
		Lb.	*Per cent.*	*Per cent.*	*In.*		
11840	3	52,200	14.5	16.3	.13, .16*	.....	Lavender and lemon yellow.
11855	3	61,600	19.0	20.8	.21,* .17	.....	Light yellow.
11869	3	61,800	31.5	27.4	.28, .35	.....	Do.
11875	3	58,200	16.0	20.8	.16,* .16*	.....	Light yellow and lemon.
11895	3	63,400	25.5	23.0	.23, .28*	.....	Light lemon.
11903	3	59,000	11.5	14.0	.10, .13*	.....	Do.
11907	3	63,400	23.0	23.0	.24,* .22	.....	Do.
11913	3	62,200	18.0	20.8	.17, .19*	.....	Do.
11920	3	63,000	26.5	25.2	.25, .28*	.....	Do.
11924	3	46,600	8.0	9.3	.10,* .06	.....	Light yellow.
11928	3	65,800	15.0	16.3	.14, .16*	.....	Do.
11933	3	66,000	18.0	18.6	.20,* .16	.....	Do.
11942	3	63,200	26.0	23.0	.27,* .25	.....	Do.
11949	3	62,000	14.0	16.3	.15,* .13	.....	Do.
11961	3	60,400	21.5	25.2	20, .23*	.....	Do.
11969	3	64,400	13.5	14.0	.15,* .12	.....	Do.
11975	3	63,600	28.5	27.4	.30,* .27	.....	Do.
11987	3	61,600	12.0	14.0	.12, .12	.....	Do.
11992	3	47,200	10.5	9.3	.07, .14*	.....	Light yellow and lemon.
12004	3	66,800	18.0	20.8	.16, .20*	.....	Light yellow.
12006	3	44,600	8.0	9.3	.10,* .06	.....	Light yellow and lemon.
12008–2	3	59,000	11.0	13.2	.13,* .09	.....	Light yellow.
12016	3	53,400	11.5	11.6	.10, .13*	.....	Light yellow and lemon.
12025	3	66,400	23.0	20.8	.26,* .20	.....	Light yellow.
12035	3	62,200	11.5	11.6	.14,* .09	.....	Do.
12043	3	66,800	15.0	14.0	.17,* .13	.....	Do.
12061	3	62,200	12.5	14.0	.10, .15*	.....	Do.
12075	3	49,600	6.5	9.3	.05, .08*	.....	Light yellow and lemon.
12081	3	65,600	17.5	18.6	.15, .20*	.....	Light yellow.
12091	3	48,400	10.5	11.6	.12,* .09	.....	Lavender and lemon yellow.
12099	3	67,600	20.0	20.8	.20,* .20	.....	Light yellow.
12110	3	44,200	8.5	10.5	.06, .11*	.....	Lavender and lemon yellow.
12110–2	3	64,400	14.5	16.3	.14, .15*	.....	Light yellow.
12123	3	65,800	23.5	23.0	.25,* .22	.....	Light yellow oblique.
12137	3	65,400	22.5	23.0	.25,* .20	.....	Light yellow.
12151	3	64,600	22.0	22.2	.21, .23*	.....	Do.
12161	3	65,200	13.5	13.2	.12, .15*	.....	Do.
12169	3	69,000	12.5	13.2	.14,* .11	.....	Do.
12179	3	63,300	9.5	13.2	.11,* .08	.....	Do.
12183	3	59,500	7.5	10.8	.06, .09*	.....	Do.
12185	3	57,600	13.0	15.5	.11, .15*	.....	Lavender and lemon yellow.
12193	3	54,000	10.0	13.2	.08, .12*	.....	Light yellow and lemon yellow.
12200	3	63,900	18.5	20.1	.16, .21*	.....	Do.
12212	3	55,800	11.0	10.8	.10, .12*	.....	Light yellow.
12221	3	55,400	12.5	14.0	.14,* .11	.....	Do.
12236	3	65,000	17.0	14.0	.16, .18	.....	Do.
12243	3	49,400	10.0	9.3	.09, .11*	.....	Do.
12249	3	45,600	7.0	9.3	.05, .09*	.....	Do.
12259	3	65,800	22.0	23.0	.22,* .22*	.....	Do.
12265	3	65,800	14.0	14.0	.12, .16*	.....	Do.
12272	3	67,600	14.0	14.0	.15,* .13	.....	Do.
12278	3	69,000	13.5	14.0	.10, .17*	.....	Do.
12285	3	59,800	17.5	20.8	.20,* .15*	.....	Light yellow and lavender.
12293	3	61,800	18.5	20.8	.16, .21*	.....	Light yellow.
12298	3	63,200	25.0	25.2	.24, .26*	.....	Do.
12308	3	60,800	22.0	23.0	.25,* .19	.....	Do.
12314	3	66,600	21.0	23.0	.22,* .20	.....	Do.
12318	3	61,800	17.0	20.8	.16, .18*	.....	Light yellow and lavender.
12322	3	63,000	20.0	18.6	.20,* .20*	.....	Do.
12331	3	60,200	16.0	20.8	.20,* .12	.....	Do.
12342	Phos. Br.	31,800	39.5	31.6	.35, .44*	.....	Golden yellow.
12333	3	61,400	22.0	23.0	.24,* .20	.....	Light yellow.
12343	3	65,000	21.5	23.0	.20, .23*	.....	Do.
12348	3	59,800	7.5	9.3	.10,* .05	.....	Do.
12357	4	75,200	20.5	18.6	.22,* .19	.....	Do.
12360	4	68,200	36.0	29.5	.35, .37*	.....	Do.
12368	3	60,400	19.0	18.6	.17, .21*	.....	Light yellow and lavender.
12378	4	67,400	35.0	31.6	.33, .37*	.....	Light yellow.
12383	4	66,600	32.5	29.5	.34,* .31	.....	Do.
12391	3	63,600	15.5	16.3	.14, .17*	.....	Do.
12418	4	65,200	40.0	33.6	.44,* .36	.....	Do.
12424	3	62,200	15.0	16.3	.16,* .14	.....	Do.
12440	4	64,600	38.5	33.6	.38,* .39*	.....	Do.
12433	4	64,000	33.0	29.5	.36,* .30	.....	Do.
12447	4	64,400	38.0	33.6	.38,* .38	.....	Do.
12452	3	63,200	20.5	20.8	.20, .21*	.....	Do.
12458	4	62,600	26.5	27.4	.24, .29*	.....	Do.
12460	3	57,600	16.0	16.3	.14, .18*	.....	Do.

Bronze from Watertown Arsenal foundry—Continued.

Marks.	Grade.	Tensile strength per sq. in.	Elongation.	Contraction of area.	Elongation of inch sections.	Sclero-scope hard-ness.	Appearance of fracture.
		Lb.	*Per cent.*	*Per cent.*	*In.*		
12462	4	64,600	38.0	33.6	0.40,*.036*	.....	Light yellow.
12467	4	63,600	39.0	35.7	.39,*.39*	.....	Do.
12469	3	62,400	26.5	29.5	.26,*.27*	.....	Do.
12475	4	64,800	34.5	33.6	.33, .36*	.....	Do.
12480	4	62,600	41.5	39.6	.42,*.41*	.....	Do.
12482	3	62,600	19.0	20.8	.21,*.17	.....	Light yellow and lavender.
12494	4	63,400	27.0	27.4	.30,*.24	.....	Light yellow.
12497	4	66,400	39.0	35.7	.39,*.39*	.....	Do.
12499	3	63,400	32.0	29.5	.29, .35*	.....	Do.
12508	3	64,700	35.5	30.5	.39,*.32	.....	Do.
12511	4	68,600	29.0	27.4	.31,*.27	.....	Do.
12513	3	63,800	33.0	27.4	.32,*.34*	.....	Do.
12519	4	63,600	29.0	29.5	.32, .35*	23.0	Do.
12521	3	60,000	17.0	23.0	.19,*.15	22.0	Light yellow and lavender.
12531	3	62,600	36.0	31.6	.32, .40*	22.0	Light yellow.
12542	3	63,400	16.5	18.6	.15, .18*	22.0	Light yellow and lavender.
12553	3	61,200	23.0	25.4	.20, .26*	22.0	Light yellow.
12566	3	61,600	16.5	18.6	.19,*.14	25.0	Do.
12571	3	61,600	12.5	14.0	.14,*.11	27.0	Do.
12573	3	64,400	23.0	23.0	.27,*.19	25.0	Do.
12583	3	63,800	22.5	23.0	.25,*.20*	25.0	Do.
12592	3	60,000	16.0	20.8	.15, .17*	24.5	Do.
12611	3	67,600	16.0	18.6	.17,*.15	25.0	Do.
12620	3	61,200	18.5	18.6	.16, .21*	24.0	Lavender.
12626	3	32,400	5.0	6.7	.01, .09*	23.0	Light yellow and greenish.
12626–2	.....	40,200	4.5	6.7	.06,*.03	22.0	Light yellow and lemon yellow.
12626–3	.....	47,400	9.5	9.3	.07, .12*	24.0	Light yellow and lavender.
12633	3	65,200	15.5	14.0	.16,*.15*	25.0	Light yellow.
12640	4	66,400	37.5	33.6	.39,*.36	23.0	Uniform light yellow; silky.
12599	3	61,400	19.0	18.6	.17, .21*	23.0	Light yellow and lavender.
12649	3	62,000	16.0	18.6	.15, .17*	29.0	Light yellow.
12666	4	65,800	34.5	33.6	.36,*.33*	24.0	Do.
12678	4	63,200	39.0	37.7	.39,*.39*	23.0	Uniform light yellow; silky.
12658	3	61,200	18.0	20.8	.17, .19*	24.0	Light yellow.
12687	4	65,400	35.5	33.6	.35,*.36*	32.0	Do.
12693	3	60,000	18.5	18.6	.19,*.18*	23.5	Light yellow and lavender.
12725	4	65,000	36.0	31.6	.39,*.33	31.0	Light yellow; uniform.
12729	3	63,800	42.0	35.7	.42,*.42*	24.0	Do.
12734	4	61,800	39.0	33.6	.38, .40*	22.0	Do.
12737	4	62,800	38.5	35.7	.42,*.35	32.0	Do.
12740	3	65,200	18.5	18.6	.20,*.17	24.0	Do.
12747	4	65,400	36.0	33.6	.37,*.35*	23.5	Do.
12750	4	62,400	36.0	33.6	.38,*.34*	23.0	Do.
12752	4	64,000	37.0	33.6	.35, .39*	22.0	Do.
12755	4	62,800	38.0	33.6	.41,*.35	21.0	Do.
12757	4	61,600	36.0	31.6	.36,*.36*	21.0	Do.
12759	3	54,600	5.5	6.7	.07,*.04	30.0	Do.
12766	3	51,800	10.0	11.6	.13,*.07	22.0	Light yellow and lavender.
12773	3	59,600	11.5	11.6	.10, .13*	23.0	Light yellow.
12782	3	58,800	12.5	14.0	.11, .14*	26.0	Light yellow and lavender.
12796	3	49,400	12.0	11.6	.10, .14*	26.0	Do.
12808	3	58,800	15.5	16.3	.14, .17*	27.0	Do.
12817	3	62,000	15.5	18.6	.17,*.14*	27.0	Light yellow.
12821	3	62,000	15.5	18.6	.14, .17*	25.5	Do.
12825	3	64,400	18.5	16.3	.20,*.17*	26.5	Do.
12835	3	56,400	16.5	20.8	.20,*.13	25.5	Light yellow and lavender.
12839	3	62,400	17.0	16.3	.20,*.14	26.0	Light yellow.
12841	3	60,400	15.5	18.6	.18,*.13	27.0	Light yellow and lavender.
12852	3	62,800	16.5	16.3	.19,*.14*	25.0	Light yellow.
12864	3	60,800	14.5	16.3	.14, .15*	25.0	Do.
12874	3	60,000	12.0	11.6	.10, .14*	26.0	Light yellow and lavender.
12877	3	62,800	13.5	16.3	.12, .15*	26.0	Light yellow.
12881	3	57,600	7.5	9.3	.07, .08*	27.0	Do.
12894	3	61,200	13.5	14.0	.12, .15*	25.0	Light yellow and lavender.
12898	4	63,800	25.0	25.2	.23, .27*	23.0	Light yellow.
12899	3	64,600	21.0	20.8	.23,*.19	28.0	Do.
12927	3	62,200	16.5	18.6	.18,*.15	27.0	Do.
12942	3	64,800	20.0	18.6	.19, .21*	25.0	Do.
12957	3	61,400	17.5	18.6	.16, .19*	24.0	Do.
12961	3	53,600	7.5	11.6	.07, .08	25.0	Light yellow, with dark spot at circumference.
12967	3	64,400	19.5	20.8	.21,*.18	26.0	Light yellow.
12982	3	59,800	13.0	16.3	.15,*.11	31.0	Light yellow and lavender.
12986	3	61,800	15.0	18.6	.17,*.13	26.0	Light yellow.
13008	3	64,800	24.0	23.0	.22, .26*	26.0	Do.
13012	3	62,800	12.5	14.0	.14,*.11	25.0	Do.
13015	3	64,000	13.0	14.0	.16,*.10	30.0	Do.
13023	3	61,000	15.5	16.3	.14, .17*	25.5	Do.

Bronze from Watertown Arsenal foundry—Continued.

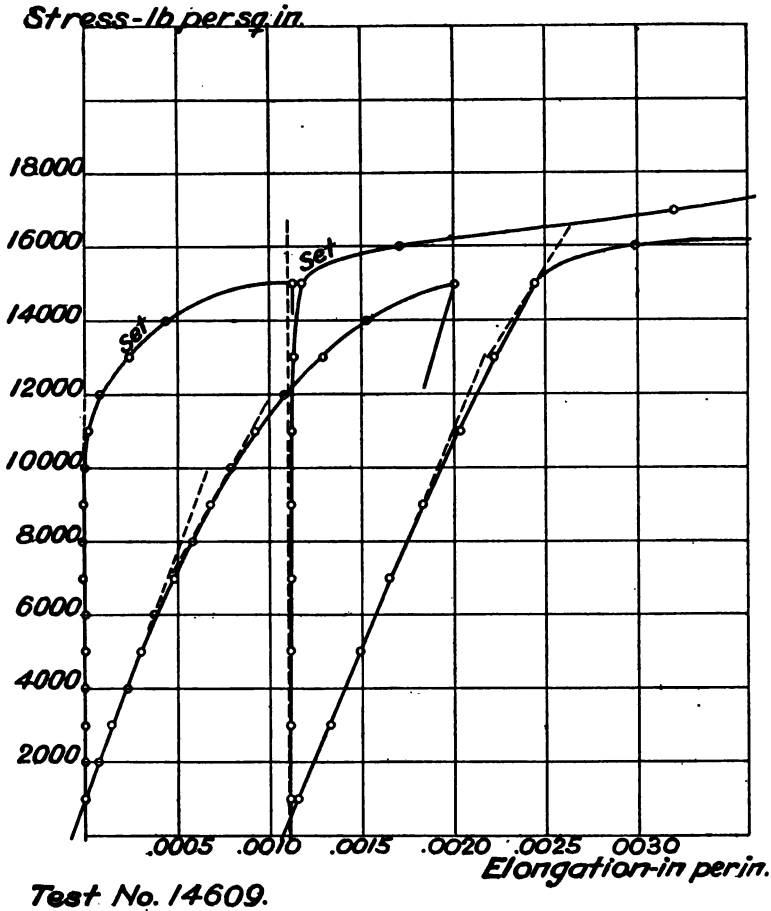
Marks.	Grade.	Tensile strength per sq. in.	Elongation.	Contraction of area.	Elongation of inch sections.	Sclero-scope hardness.	Appearance of fracture.
		Lb.	*Per cent.*	*Per cent.*	*In.*		
13026	3	60,400	13.5	16.3	0.16,*0.11	25.5	Light yellow.
13031	3	60,600	16.0	18.6	.18,*.14	25.0	Light yellow and lavender.
13034	3	61,600	12.5	14.0	.14,*.11	26.0	Light yellow.
13039	3	60,400	16.5	18.6	.14, .19*	24.0	Do.
13056	3	61,400	18.5	18.6	.21,*.16	23.5	Do.
13068	4	67,200	36.0	33.6	.35, .37*	22.0	Light yellow; uniform.
13079	3	59,400	15.5	16.3	.13, .18*	22.0	Light yellow.
13108	3	63,200	15.5	16.3	.14, .17*	26.0	Do.
13132	3	68,000	30.0	29.5	.30,*.30*	26.0	Do.
13144	3	62,600	22.0	20.8	.23,*.21	25.0	Do.
13174	3	59,400	8.5	9.3	.08, .09*	29.0	Uniform light yellow.
13204	3	60,800	16.5	18.6	.18,*.15	26.0	Light yellow.
13241	4	63,000	34.5	31.6	.32, .37*	21.0	Uniform light yellow, oblique.
13250	3	61,600	16.5	18.6	.15, .18*	24.5	Uniform light yellow.
13256	3	62,400	23.5	20.8	.12, .35*	23.0	Reddish brown light spot.
13258	4	65,200	38.5	30.0	.37, .40*	23.5	Light yellow.
13261	3	62,400	25.0	23.5	.23, .27*	23.0	Do.
13267	3	60,600	21.0	20.8	.23,*.19	23.0	Light yellow and lavender.
13299	3	60,000	17.5	18.6	.19,*.16	23.0	Do.
13339	3	59,600	24.0	25.2	.21, .27*	22.5	Do.
13371	3	63,200	20.0	20.8	.22,*.18	24.0	Light yellow.
13405	3	61,600	15.5	20.8	.18,*.13	28.0	Do.
13439	3	62,600	16.5	18.6	.15, .18*	28.5	Do.
13472	4	62,800	41.5	37.7	.41,*.42*	25.0	Do.
13491	3	61,800	15.0	18.6	.17,*.13	26.0	Do.
13531	3	59,200	15.0	16.3	.17,*.13	24.5	Light yellow, with lavender spots.
13571	3	63,600	20.0	20.8	.22,*.18	25.5	Do.
13627	3	62,000	11.5	14.0	.13,*.10	28.0	Do.
13672	3	60,200	13.0	14.0	.14,*.12	24.5	Light yellow.
13705	3	59,000	13.5	14.0	.12, .15*	24.0	Do.
13738	3	60,200	14.5	16.3	.13, .16*	24.0	Do.
13741	3	62,600	28.5	25.2	.31,*.26	21.5	Do.
13747	4	64,200	35.0	29.5	.35,*.35*	22.0	Do.
13752	4	62,400	40.0	33.6	.41,*.39*	23.0	Do.
13769	3	62,800	32.0	30.5	.30, .34*	23.0	Light golden yellow.
13772	3	64,400	31.0	27.4	.29, .33*	23.0	Light yellow; silky.
13777	4	62,000	39.5	35.7	.42,*.37	29.0	Light yellow.
13793	4	62,000	41.0	35.7	.40, .42*	21.0	Do.
13799	4	58,200	18.5	18.6	.20,*.17*	31.0	Light yellow, with golden yellow spots.
13799-2	.....	57,200	16.5	20.8	.19,*.14	25.0	Light yellow and lemon yellow.
13800	3	53,600	10.0	14.0	.11,*.09	29.0	Light yellow with golden yellow and lavender spots.
13826	3	62,800	32.0	29.5	.35,*.29	22.0	Light yellow.
13870	3	60,400	23.0	23.0	.21, .25*	22.0	Light yellow and lavender.
13896	3	59,200	13.5	14.0	.14,*.13	33.5	Do.
13898	4	62,600	40.5	33.6	.42,*.39	24.0	Light yellow.
13901	3	53,000	7.5	9.5	.08,*.07*	25.0	Light yellow and lavender.
13903	4	62,400	42.5	35.7	.41,*.44*	24.0	Light yellow.
13905	3	62,000	17.0	18.6	.18,*.16	30.0	Light yellow and lavender.
13907	4	62,000	36.5	31.6	.37,*.36*	21.0	Uniform light yellow.
13910	4	65,000	32.5	29.5	.30, .35*	21.5	Do.
13912	3	52,800	14.0	14.0	.11, .17*	22.0	Light yellow and lavender.
13914	3	35,400	8.0	9.3	.11,*.05	21.0	Light yellow and lemon yellow.
13914-2	3	37,800	11.5	4.4	.07, .16*	24.0	Do.
13916	3	42,000	9.5	9.3	.12,*.07	22.0	Do.
13916-2	3	40,200	9.0	9.3	.06, .12*	25.0	Do.
13916-3	3	37,800	7.5	11.6	.11,*.04	33.0	Do.
13918	3	56,800	36.5	31.6	.34, .39*	19.0	Light yellow.
13930	3	42,800	6.0	6.7	.04, .08*	24.5	Light yellow and lemon yellow.
13930-2	3	43,600	6.5	4.4	.04, .09*	25.5	Do.
13936	4	64,600	37.0	33.6	.49,*.25	23.0	Uniform light yellow.
13938	4	67,400	26.0	27.4	.23, .29*	25.0	Light yellow.
13944	4	63,200	40.0	35.7	.39, .41*	21.5	Uniform light yellow.
13949	3	60,800	17.0	24.0	.16, .18*	24.0	Light yellow and lavender.
13969	3	50,000	10.5	9.3	.08, .13*	24.0	Light yellow and lemon yellow.
13971	3	61,400	37.0	33.6	.36, .38*	21.0	Uniform light yellow.
13973	4	65,200	37.0	35.7	.38,*.36	23.5	Do.
13978	3	61,000	10.5	11.6	.13,*.08	26.5	Light yellow and lavender.
13980	3	60,200	18.5	16.3	.19, .18	21.0	Do.
13981	3	45,600	6.5	4.4	.10,*.03	24.5	Light yellow and lemon yellow.
13987	3	56,400	7.0	6.7	.06, .08*	26.5	Light yellow.
13989	4	64,000	33.0	29.5	.32, .34*	25.0	Uniform light yellow.
13992	3	48,200	7.5	9.3	.08,*.07	29.0	Light and lemon yellow.
13994	3	61,600	10.0	11.6	.13,*.07	34.0	Light yellow.
13995	4	63,400	41.0	37.7	.43,*.39	24.5	Uniform light yellow.
13998	4	63,200	41.0	37.7	.44,*.38	22.5	Do.

Bronze from Watertown Arsenal Foundry—Continued.

Marks.	Grade.	Tensile strength per sq. in.	Elongation.	Contraction of area.	Elongation of inch sections.	Sclero-scope hardness.	Appearance of fracture.
		Lb.	*Per cent.*	*Per cent.*	*In.*		
14006	3	39,600	6.0	6.7	0.10, 0.02	26.0	Light yellow and lavender.
14006–2	3	52,000	12.5	14.0	.11, .14*	25.0	Do.
14008	3	62,200	19.0	23.0	.18, .20*	26.0	Do.
14011	3	56,200	14.0	16.3	.16,* .12	23.5	Do.
14025	3	52,400	8.0	9.3	.07, .09*	29.0	Do.
14027	3	49,600	7.5	6.7	.05, .10*	31.0	Do.
14029	3	61,800	17.5	18.6	.21,* .14	25.0	Do.
14034	3	48,600	9.0	9.3	.12,* .06	32.0	Do.
14036	3	59,600	21.5	23.0	.23,* .20	21.5	Do.
14044	3	26,200	4.5	6.7	.06,* .03	18.5	Silvery, with two small lemon yellow spots.
14044–2	3	26,200	4.0	4.4	.05, .03	18.0	Silvery, with small yellow spot at circumference.
14048	3	61,600	25.0	23.0	.28,* .22	20.0	Light yellow.
14053	3	58,000	18.0	20.8	.16, .20*	22.0	Do.
14061	4	63,600	36.5	33.6	.36, .37	24.0	Uniform light yellow.
14068	4	67,800	31.0	29.5	.30, .32*	24.0	Do.
1	4	63,400	23.0	23.0	.26,* .20	24.5	Light yellow.
7	4	64,600	28.0	29.5	.31,* .25	29.0	Uniform light yellow.
16	4	61,800	43.5	41.6	.43,* .44*	23.0	Do.
26	3	60,000	15.0	18.6	.14, .16*	29.0	Light yellow and lavender.
35	3	61,200	29.5	29.5	.33, .26	22.0	Light yellow.
46	3	63,000	16.0	18.6	.18,* .14	24.0	Do.
53	3	57,000	12.5	16.3	.10, .15*	23.5	Do.
58	3	55,000	7.5	9.3	.07 .08*	29.0	Do.
60	3	57,800	8.0	9.3	.06, .10*	29.0	Do.
70	3	57,800	15.0	16.3	.16,* .14	23.0	Do.
74	3	57,700	6.5	8.5	.08,* .05	30.0	Do.
86	3	60,200	16.5	16.3	.19,* .14	25.0	Do.
90	3	57,300	8.5	11.1	.07, .10*	29.0	Do.
106	3	59,400	12.5	16.3	.14,* .11	26.0	Do.
108	4	58,800	22.5	22.8	.25,* .20	23.5	Uniform light yellow.
		56,600	19.5	25.2	.18, .21*	25.0	Light yellow, mottled with lemon yellow.
108–3	4	65,000	23.5	23.0	.25,* .22	24.0	Light yellow.
113	4	62,800	35.5	33.2	.35,* .36*	28.0	Uniform light yellow.
119	3	60,000	13.5	18.6	.15,* .12	31.0	Light yellow.
126	4	58,600	21.0	25.2	.24,* .18	30.0	Light yellow, with golden yellow spots.
126–2	4	64,600	37.5	31.6	.40,* .35	25.0	Light yellow.
129	4	63,600	34.0	31.6	.36,* .32	30.0	Uniform light yellow.
133	3	59,600	16.0	16.3	.17,* .15	37.0	Light yellow.
140	4	63,800	24.0	25.2	.21, .27*	27.0	Uniform light yellow.
144	3	59,200	14.0	16.3	.14,* .14*	27.0	Light yellow.
205	3	59,400	12.0	14.0	.14,* .10	31.0	Do.
207	3	56,800	8.5	11.6	.10,* .07	33.0	Do.
236	3	57,600	11.0	14.0	.13,* .09	29.0	Do.
269	4	69,000	30.5	29.5	.29,* .32	27.0	Do.
273	3	61,200	14.0	14.0	.16, .14	30.0	Do.
285	3	59,400	15.0	20.8	.18,* .12	28.0	Do.
312	4	66,400	36.5	29.5	.38,* .35*	24.0	Do.
320	3	59,600	12.0	14.0	.14,* .10	26.0	Do.
342	3	56,600	11.0	11.6	.07, .15*	28.0	Do.
363	4	66,400	34.5	29.5	.36,* .33	27.0	Do.
370	3	57,400	20.0	20.8	.23,* .17	27.0	Do.
389	3	59,200	24.5	25.2	.28,* .21	24.0	Do.
396	3	60,600	23.0	23.0	.24, .22	23.0	Do.
413	4	64,200	39.0	33.6	.40,* .38	24.0	Do.
415	3	56,200	10.0	9.3	.14,* .06	27.0	Do.
416	3	59,600	25.0	25.2	.27,* .23	22.0	Do.
417	4	65,600	34.0	31.6	.35,* .33	24.0	Do.
419	3	57,400	14.5	16.3	.16,* .13	24.0	Light yellow and lavender.
420	4	63,400	35.0	31.6	.36,* .34*	22.0	Light yellow.
423	3	58,800	24.0	20.8	.22, .26*	22.0	Do.
424	4	62,400	39.0	33.6	.39,* .39*	22.0	Do.
428	4	71,000	22.5	20.8	.22,* .23*	25.0	Do.
430	4	66,400	34.0	29.5	.35,* .33*	22.0	Do.
431	3	59,000	19.0	18.6	.19,* .19*	22.0	Do.
433	3	60,400	25.0	25.2	.22, .28*	21.0	Do.
435	3	61,600	23.5	23.0	.21, .26*	27.0	Do.
437	3	60,600	15.0	18.6	.13, .17*	27.0	Do.
440	3	62,200	21.0	25.2	.20,* .22*	24.0	Do.
443	3	57,400	10.0	11.6	.12,* .08	29.0	Do.
445	3	61,000	19.0	20.8	.16, .22*	27.0	Do.
447	3	61,800	26.0	25.2	.24, .28*	24.0	Do.
449	4	67,200	31.0	29.5	.32,* .30	32.0	Do.

Bronze from Watertown Arsenal Foundry—Continued.

Marks.	Grade.	Tensile strength per sq. in.	Elongation.	Contraction of area.	Elongation of inch sections.	Sclero-scope hardness.	Appearance of fracture.
		Lb.	*Per cent.*	*Per cent.*	*In.*		
465	4	67,000	35.0	31.6	0.37,*0.33	32.0	Light yellow.
483	3	58,400	14.0	16.3	.15,* .13	26.0	Do.
534	4	63,800	35.0	31.6	.39,* .31	23.0	Uniform light yellow.
542	4	62,400	40.0	33.6	.38, .42*	24.0	Light yellow.
548	4	65,800	35.5	33.6	.36,* .35*	24.0	Do.
553	3	62,800	19.0	20.8	.22,* .16	25.0	Do.
601	4	62,400	36.0	31.6	.35, .37*	24.0	Do.
608	3	44,000	10.5	11.6	.07, .14*	23.0	Lavender and golden yellow.
608–2	3	46,000	11.5	14.0	.14,* .09	20.0	Light yellow.
614	4	64,200	33.5	29.5	.32, .35*	24.0	Do.
617	3	62,000	20.5	20.8	.23,* .18	24.0	Do.
619	3	60,400	30.5	29.5	.29, .32*	22.0	Do.
621	3	60,200	14.5	16.3	.12, .17*	25.0	Do.
623	4	65,800	35.5	33.6	.36,* .35	25.0	Do.
624	4	62,800	34.0	29.5	.32 .36*	25.0	Do.
625	3	55,600	7.0	9.3	.05 .09*	28.0	Do.
630	3	52,600	12.0	14.0	.10 .14*	25.5	Light yellow and lavender.
632	3	59,800	23.5	23.0	.26,* .21	22.5	Do.
636	3	48,400	7.5	11.6	.10, .05	23.0	Do.
641	3	60,200	17.5	18.6	.17, .18	22.0	Do.
642	3	42,800	7.0	9.3	.06, .08*	23.0	Light and lemon yellow.
644	4	67,000	29.0	27.4	.30,* .28*	23.0	Light yellow.
647	3	59,200	12.5	14.0	.14,* .11	22.0	Do.
650	3	60,000	14.0	14.0	.15,* .13	24.0	Do.
656	3	62,800	21.5	20.8	.23,* .20	24.0	Do.
662	3	56,600	9.5	11.6	.07, .12*	26.0	Do.
670	3	60,400	15.5	16.3	.17,* .14	24.0	Do.
671	3	60,800	21.0	20.8	.19, .23*	22.0	Do.
672	3	61,000	13.0	14.0	.14,* .12	32.0	Do.
673	3	64,000	17.5	16.3	.19,* .16	37.0	Do.
674	4	67,800	21.5	23.0	.24,* .19	32.0	Do.
681	3	58,400	7.0	9.3	.06, .08*	28.0	Do.
682	3	64,200	32.0	27.4	.34,* .30	25.0	Do.
684	3	64,200	14.0	14.0	.13,* .15*	28.0	Do.
687	4	67,000	33.0	29.5	.35,* .31	22.0	Do.
697	4	67,200	35.5	33.6	.39,* .32	24.0	Do.
707	3	69,400	19.5	20.8	.18, .21*	27.0	Do.
708	3	70,000	24.5	23.0	.27,* .22	22.0	Do.
709	4	67,200	31.0	31.6	.34,* .28	22.0	Do.
715	4	67,400	35.0	31.6	.33, .37*	22.0	Do.
719	3	58,200	24.0	23.0	.22, .26*	21.0	Do.
720	3	65,200	29.5	27.4	.32,* .27	24.0	Do.
721	4	64,000	38.5	33.6	.37, .40*	23.0	Uniform light yellow, silky, oblique.
724	3	61,200	21.5	23.0	.19, .24*	23.0	Light yellow.
726	3	64,400	26.0	25.2	.24, .28*	22.0	Do.
727	3	59,400	20.0	23.0	.18, .22	22.0	Do.
729	3	59,200	21.5	23.0	.22, .21	22.0	Do.
731	3	52,200	10.5	14.0	.13,* .08	26.0	Do.
732	3	58,400	14.0	16.3	.12, .16*	27.0	Do.
733	4	68,400	37.5	33.6	.39,* .36*	25.0	Uniform light yellow.
734	3	62,200	24.0	29.5	.26,* .22	25.0	Light yellow.
735	3	62,000	20.0	20.8	.17, .23*	23.0	Do.
736	4	66,900	24.5	29.5	.28,* .21	25.0	Do.
737	4	67,000	31.0	31.6	.32,* .30*	25.5	Do.
743	3	56,800	15.0	20.8	.12, .18*	22.0	Light yellow, silvery spot at circumference.
744	3	58,000	14.5	18.6	.12, .17*	23.0	Light yellow.
745	3	57,400	18.0	20.8	.16, .20*	22.0	Do.
746	3	41,200	8.0	9.3	.05, .11*	22.5	Light yellow and lemon yellow.
747	3	60,800	14.5	18.6	.12, .17*	22.0	Do.
748	3	54,000	13.0	18.6	.13,* .13*	22.0	Light yellow, silvery spot at circumference.
749	4	65,000	32.0	33.6	.29, .35*	22.0	Light yellow.
753	4	66,200	27.5	31.6	.26, .29*	22.5	Do.
760	3	63,800	30.0	31.6	.27, .33*	23.0	Do.
761	3	58,200	18.0	27.4	.14, .22*	23.0	Do.



Test No. 14609.

Remelted Gun Metal Bronze.
Copper 88, Tin 10, Zinc 2 per cent.

TEST 14609.

TENSILE TEST OF BRONZE SPECIMEN.

(See Test No. 14597.)

Marks, 13767–2.
Diameter, 0.798 in.
Sectional area, 0.50 sq. in.
Gauged length, 10 in.

Load.	Stress per sq. in.	In gauged length.		Remarks.
		Elongation.	Set.	
Lb.	*Lb.*	*In.*	*In.*	
500	1,000	0.	0.	
1,000	2,000	.0007	0.	
1,500	3,000	.0014	0.	
2,000	4,000	.0023	0.	
2,500	5,000	.0030	0.	
3,000	6,000	.0037	0.	
3,500	7,000	.0048	−.0001	
4,000	8,000	.0058	−.0001	
4,500	9,000	.0068	−.0001	
5,000	10,000	.0079	0.	
5,500	11,000	.0092	.0002	
6,000	12,000	.0108	.0008	
6,500	13,000	.0129	.0024	
7,000	14,000	.0153	.0044	
7,500	15,000	.0205	.0113	
500	1,000	.0115	.0110	
1,500	3,000	.0133	.0110	
2,500	5,000	.0149	.0110	
3,500	7,000	.0165	.0112	
4,500	9,000	.0183	.0112	
5,500	11,000	.0204	.0112	
6,500	13,000	.0222	.0113	
7,500	15,000	.0244	.0118	
8,000	16,000	.0299	.0171	
8,500	17,000	.0458	.0320	
9,000	18,000	.0666 .0800	.0646	
9,500	19,000	.1035	.....	
10,000	20,000	.18 .20	....	
10,500	21,000	.23	.....	
13,700	27,400	.....	.....	Tensile strength.

Elongation after fracture, 0.78 in. in 10 in. = 7.8 per cent.

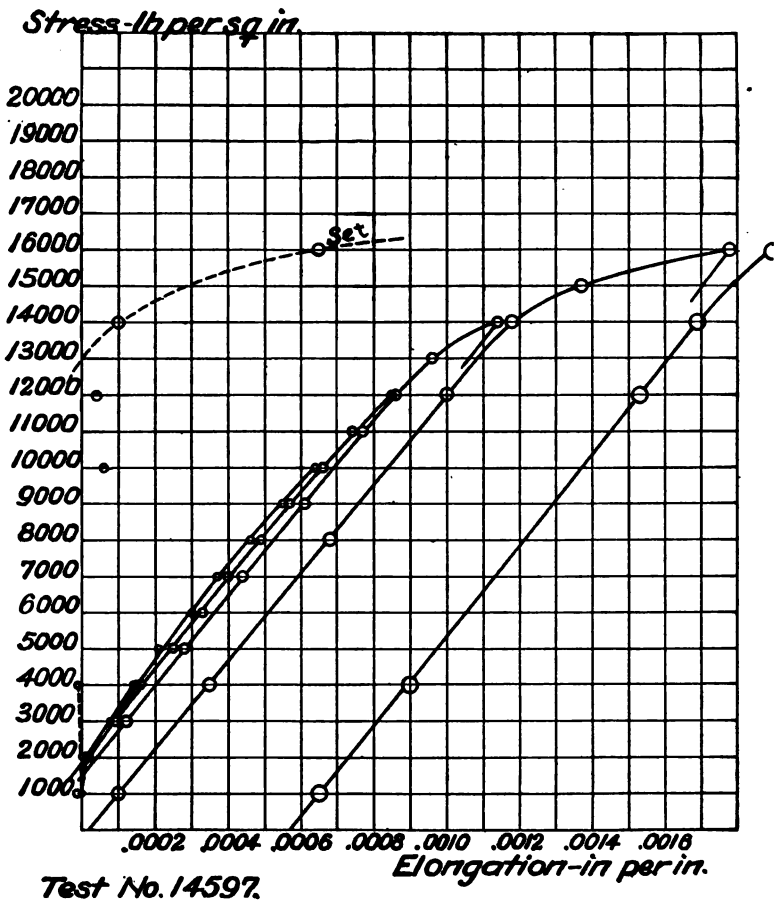
Elongation of inch sections: 0.13*, 0.09, 0.06, 0.07, 0.07, 0.08, 0.08, 0.06, 0.08, 0.06 in.

Diameter at fracture, 0.76 in.

Sectional area, 0.454 sq. in.

Contraction of area, 9.2 per cent.

Appearance of fracture light and golden yellow; silvery spots, dark spot on one side.



Test No. 14597.

Remelted Gun Metal Bronze
Copper 88, Tin 10 Zinc 2 percent.

TEST 14597.

TENSILE TEST OF A SPECIMEN FROM A REMELT OF GUN METAL BRONZE OF THE FOLLOWING COMPOSITION: Cu. 88, Sn. 10, Zn. 2 PER CENT.

Sample taken from a sand-cast coupon, 14 in. long and 1 in. wide, attached along one edge to a larger block of metal to secure sound metal.

See specimens No. 13761 and 13762 for test of metal as first melted.

See specimen No. 13765 for test of metal from same heat.

Marks, 13767.

Diameter, 0.798 in.

Sectional area, 0.50 sq. in.

Gauged length, 10 in.

Load.	Stress per sq. in.	In gauged length.		Remarks.
		Elongation.	Set.	
Lb.	*Lb.*	*In.*	*In.*	
500	1,000	0.	0.	
1,000	2,000	.0001	0.	
1,500	3,000	.0008	.....	
2,000	4,000	.0014	−.0005	
500	1,000	−.0005	.....	
1,000	2,000	.0002	.....	
1,500	3,000	.0009	.....	
2,000	4,000	.0015	.....	
2,500	5,000	.0021	.....	
3,000	6,000	.0030	.....	
3,500	7,000	.0037	.....	
4,000	8,000	.0046	.....	
4,500	9,000	.0055	.....	
5,000	10,000	.0064	−.0006	
500	1,000	−.0006	.....	
1,000	2,000	.0001	.....	
1,500	3,000	.0009	.....	
2,000	4,000	.0016	.....	
2,500	5,000	.0025	.....	
3,000	6,000	.0033	.....	
3,500	7,000	.0040	.....	
4,000	8,000	.0049	.....	
4,500	9,000	.0057	.....	
5,000	10,000	.0066	.....	
5,500	11,000	.0074	.....	
6,000	12,000	.0085	−.0004	
500	1,000	−.0004	.....	
1,500	3,000	.0012	.....	
2,500	5,000	.0028	.....	
3,500	7,000	.0044	.....	
4,500	9,000	.0061	.....	
5,500	11,000	.0077	.....	
6,000	12,000	.0086	.....	
6,500	13,000	.0096	.....	
7,000	14,000	.0114	.0010	
500	1,000	.0010	.....	
2,000	4,000	.0035	.....	
4,000	8,000	.0068	.....	
6,000	12,000	.0100	.....	
7,000	14,000	.0118	.....	
7,500	15,000	.0137	.....	
8,000	16,000	.0178	.0065	
500	1,000	.0065	.....	
2,000	4,000	.0090	.....	
6,000	12,000	.0153	.....	
7,000	14,000	.0169	.....	
8,000	16,000	.0192	.....	
8,500	17,000	.0260	.....	
9,000	18,000	.0425	.....	
12,000	24,000	.3600	.3400	
500	1,000	0.	.....	Extensometer reset to zero.
2,000	4,000	.0033	.....	
4,000	8,000	.0067	.....	
6,000	12,000	.0105	.....	

Load.	Stress per sq. in.	In gauged length.		Remarks.
		Elongation.	Set.	
Lb.	*Lb.*	*In.*	*In.*	
7,000	14,000	0.0124	.....	
8,000	16,000	.0146	.....	
8,500	17,000	.0158	.....	
9,000	18,000	.0170	.....	
9,500	19,000	.0184	.....	
10,000	20,000	.0196	.....	
11,000	22,000	.0230	.....	
11,500	23,000	.0251	.....	
12,000	24,000	.0291	.....	
11,821	23,642	.0350	.....	
12,500	25,000	.0764	.....	
12,217	24,434	.0856	.....	
13,000	26,000	.1480	.....	
15,900	31,800	.....	.....	Tensile strength.

Elongation after fracture, 1.04 in. in 10 in. = 10.4 per cent.

Elongation of inch sections, 0.16*, 0.10, 0.11, 0.09, 0.09, 0.10, 0.10, 0.11, 0.09, 0.09 in.

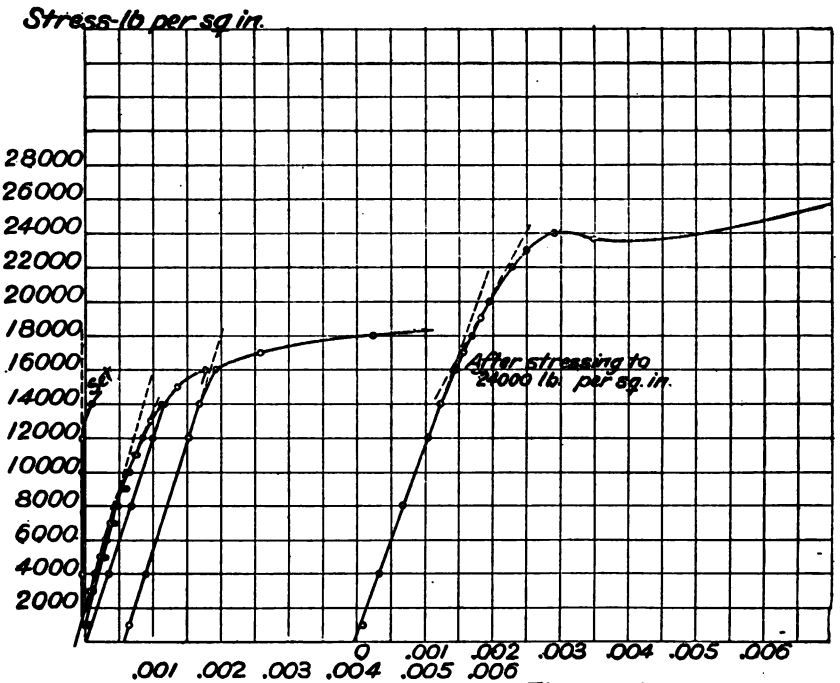
Diameter at fracture, 0.77 in.

Sectional area, 0.466 sq. in.

Contraction of area, 6.7 per cent.

Position of fracture, 0.50 in. inside of gauge mark.

Appearance of fracture chocolate and golden yellow.



Test No. 14597.

Remelted Gun Metal Bronze.

Copper 88, Tin 10, Zinc 2 percent.

CAST IRON FOR ORDNANCE WORK.

Marks.	Grade.	Tensile strength per sq. in.	Appearance of fracture.
		Lb.	
2969	2	31,500	Fine granular gray.
3010	2	31,500	Do.
3049	2	33,000	Do.
3094	2	35,000	Do.
3150	2	31,000	Do.
3203	2	31,500	Do.
3238	2	29,500	Do.
3277	2	28,100	Do.
3320	2	28,000	Do.
3324	2	29,500	Do.
3329	2	28,000	Do.
3333	2	31,000	Do.
3337	2	33,500	Do.
3342	2	31,500	Do.
3350	2	28,500	Do.
3354	2	28,500	Do.
3359	2	15,100	Do.
3359-1	2	16,000	Do.
3360	2	33,000	Do.
3365	2	24,800	Medium coarse granular.
3366-1	2	27,500	Medium fine granular gray.
3366-1	2	Not obtained.	Granular gray; defect at point of rupture.
3366-1	2	20,000	Medium fine granular.
3366-2	2	23,200	Medium fine granular, gray.
3366-2	2	30,500	Granular gray.
3366-2	2	31,500	Do.
3366-3	2	19,500	Medium coarse granular gray.
3366-4	2	23,500	Gray granular.
3367-1	2	26,000	Granular gray.
3368-1	2	27,500	Do.
3383	2	27,300	Do.
3384-1	2	28,500	Do.
3384-2	2	26,500	Medium granular.
3385-1	2	28,000	Do.
3385-2	2	26,500	Do.
3388	2	28,800	Granular gray.
3389-1	2	33,500	Do.
3389-2	2	32,000	Do.
3393	2	26,600	Do.
3393	2	29,000	Medium granular.
3398	2	30,700	Granular gray.
3399-1	2	34,500	Do.
3399-2	2	32,500	Do.
3401	1	30,500	Do.
3416	2	29,200	Do.
3418-1	2	31,500	Do.
3418-2	2	32,000	Do.
3421	1	33,000	Do.
3436	1,2	29,500	Medium granular.
3447	2	34,500	Do.
3450	1	32,000	Medium coarse granular.
3453	2	25,300	Medium coarse granular gray.
3453	2	26,000	Do.
3453-2	2	28,000	Do.
3456	2	31,000	Do.
3477	2	26,000	Do.
3477-2	2	29,500	Do.
3478-1	2	28,500	Do.
3478-2	2	29,500	Do.
3497	2	28,000	Fine granular.
3498-1	2	25,500	Medium coarse granular gray.
3498-2	2	26,000	Do.
3498-3	2	26,000	Fine granular.
3498-4	2	29,500	Do.
3498-5	2	28,500	Do.
3499-1	2	29,000	Do.
3499-2	2	34,500	Do.
3500	2	26,600	Do.
3501-1	2	31,500	Do.
3501-2	2	29,000	Do.
3502-1	2	31,000	Do.
3502-2	2	30,000	Do.
3503	2	26,000	Do.
3504-1	2	25,900	Fine granular gray.
3504-2	2	26,400	Do.
3521-1	2	30,200	Do.
3521-2	2	27,600	Do.

MISCELLANEOUS TESTS FOR ORDNANCE WORK.

TEST 14605.

SPECIMEN OF NO. 2 BRONZE FOR 14-INCH ARMY TURRETS.

Marks, 2.
Diameter, 0.798 in.
Sectional area, 0.50 sq. in.
Tensile strength, total load, 16,700 lb.
Tensile strength, stress, 33,400 lb. per sq. in.
Elongation in 3 in., 0.53 in.; 17.7 per cent.
Elongation in inch sections, 0.15, 0.23*, 0.15 in.
Diameter at fracture, 0.70 in.
Contraction of area, 23 per cent.
Appearance of fracture, light yellow.

TEST 14544.

Bending test of a steel spanner and wrench marked 80–A.

Wrench end tested on account of a defect in casting near the head.

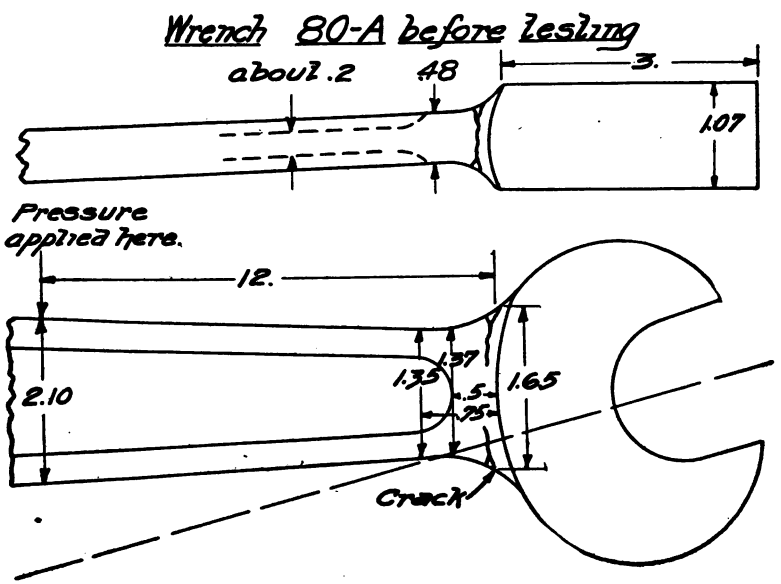
At 700 lb. wrench bent 0.75 in. from head at "A."

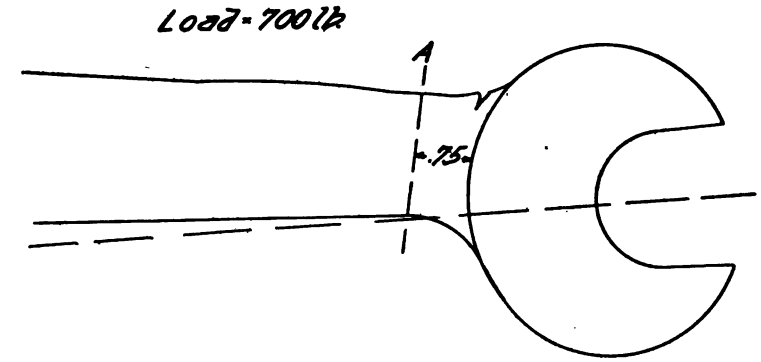
At 775 lb. wrench bent and buckled about 1.75 in. from the head at "B."

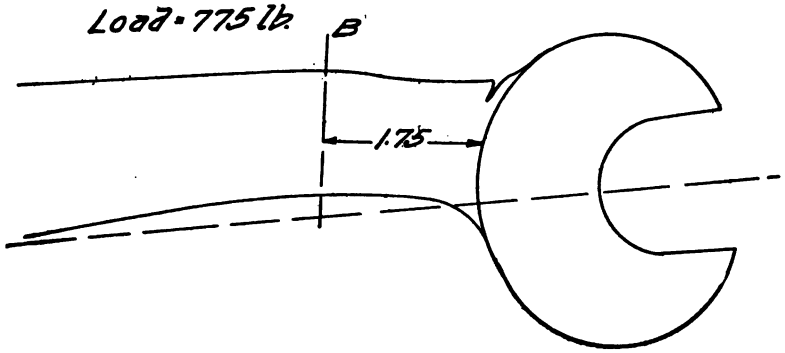
1,130 lb., ultimate strength, opened a slight crack one-half in. long on one side of wrench near the head.

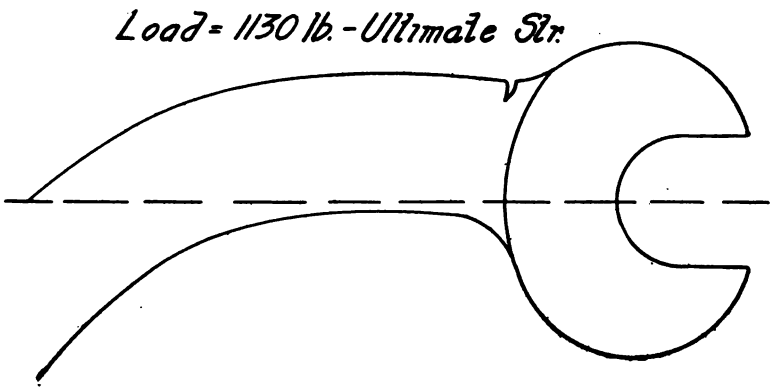
Maximum stress in metal in the plane of the crack, 62,300 lb. per sq. in.

Maximum stress in metal at smallest section, 90,400 lb. per sq. in.

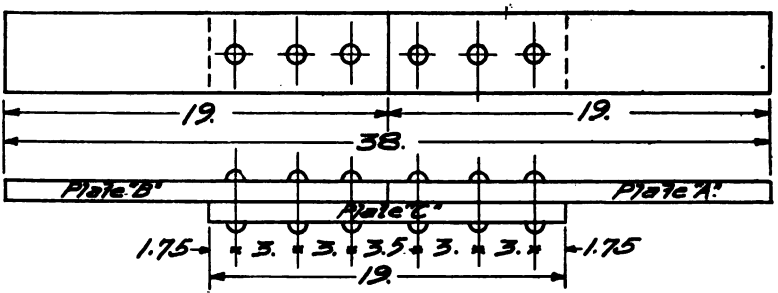


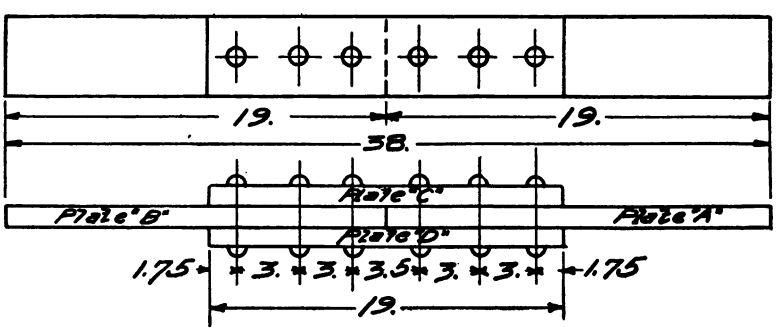

Load - 700 lb
A
.75


Load - 775 lb.
B
1.75


Load = 1130 lb. - Ultimate Str.

RIVETED JOINTS.


19.
19.
38.
Plate "B"
Plate "A"
Plate "C"
1.75
3.
3.
3.5
3.
3.
1.75
19.


19.
19.
38.
Plate "C"
Plate "B"
Plate "A"
Plate "D"
1.75
3.
3.
3.5
3.
3.
1.75
19.

RIVETED JOINTS.

Marks.	Plate A.		Plate B.		Plate C.		Load when first slipping occurred.	Ultimate load.
	Width.	Thickness.	Width.	Thickness.	Width.	Thickness.		
	In.	*In.*	*In.*	*In.*	*In.*	*In.*	*Lb.*	*Lb.*
8V	4.00	0.775	3.80	0.734	4.00	0.750	62,100	117,400
9V	4.00	.772	4.02	.775	4.02	.750	60,100	116,700
12V	3.98	.750	4.00	.740	3.98	.740	48,900	128,500
13V	3.98	.749	3.94	.745	4.01	.730	40,200	121,800
18C	4.00	.770	4.01	.745	3.99	.750	63,000	121,100
19C	4.00	.738	3.98	.776	4.02	.750	66,900	118,900
22C	3.99	.735	3.98	.742	4.00	.730	56,100	92,800
23C	4.00	.757	3.90	.775	3.96	.730	45,200	89,200

8V, first slipping, plate A; failed by shearing rivets in plate A.

9V, first slipping, plate A; failed by shearing rivets in plate A.

12V, first slipping, plate B; fractured plate A at first rivet. Appearance of fracture, granular 75 per cent, silky 25 per cent.

13V, first slipping, plate A; fractured strap at third rivet, A end.

18C, first slipping, plates A and B; failed by shearing rivets, plate A.

19C, first slipping, plate A; failed by shearing rivets, plate B.

22C, first slipping, plate B; failed by shearing rivets, plate B.

23C, first slipping, plate B; failed by shearing rivets, plate B.

Approximate diameter of rivets, measured after testing joints: Marks 8V, 9V, 22C, and 23C, $\frac{7}{8}$ inch; marks 12V, 13V, 18C, and 19C, $1\frac{1}{8}$ inch.

Load at which first slipping occurred determined by noticeable displacement of a vertical line across the edges of the plates.

Marks.	Plate A.		Plate B.		Plate C.		Plate D.		First slipping.		Ultimate load.
	Width.	Thickness.	Width.	Thickness.	Width.	Thickness.	Width.	Thickness.	Load.	Plate.	
	In.	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*Lb.*		*Lb.*
10V	4.00	1.491	4.00	1.492	4.04	0.750	4.00	0.750	120,100	A.	219,300
11V	4.00	1.489	4.02	1.499	4.02	.740	4.01	.750	133,800	A.	204,200
14V	4.02	1.493	4.00	1.490	3.97	.730	4.00	.730	124,200	B.	223,200
15V	4.00	1.492	4.02	1.492	4.00	.730	4.04	.760	124,000	B.	221,700
16C	4.00	1.487	4.01	1.505	4.01	.750	4.01	.750	119,100	A, B.	221,200
17C	4.00	1.490	4.01	1.490	3.96	.750	4.01	.730	102,400	A.	210,800
20C	4.00	1.487	4.01	1.497	4.00	.770	3.98	.730	94,200	B.	171,300
21C	4.02	1.497	4.02	1.499	4.04	.760	4.03	.750	94,600	B.	163,200

10V, at 191,000 lb. scaled on plate B; sheared rivets in plate A.

11V, at 195,500 lb. scaled on plates A and B; sheared rivets in plate B.

14V, at 155,300 lb. scaled on plate B; fractured plate A across first rivet hole.

15V, at 142,100 lb. scaled on plate A; fractured first rivet and fractured plate B across first rivet hole.

16C, at 157,300 lb. scaled on plate B; fractured plate A across first rivet hole.

17C, at 162,500 lb. scaled on plate A; sheared rivets in plate A.

20C, at 137,400 lb. scaled on plate B; sheared rivets in plate B.

21C, sheared rivets in plate A.

Approximate diameter of rivets, measured after testing joints: Marks 10V, 11V, 20C, and 21C, $\frac{7}{8}$ in.; marks 14V, 15V, 16C, and 17C, $1\frac{1}{16}$ in.

STEEL SPECIMENS FOR COMPARISON OF TESTING MACHINES.

TENSILE TESTS OF VANADIUM STEEL SPECIMENS FOR COMPARISON OF THE TESTING MACHINE OF THE CARNEGIE STEEL CO., HOMESTEAD WORKS, MUNHALL, PA.

[The inch in which fracture occurred is marked thus *.]

Test number.	Mark on specimen.	Diameter.	Sectional area.	Elastic limit.		Tensile strength.		Elongation.		Diameter at fracture.	Contraction of area.	Elongation of inch sections.	Appearance of fracture.
				Total.	Per square inch.	Total.	Per square inch.						
		In.	*Sq. in.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*In.*	*Per cent.*	*In.*	*Per cent.*	*In.*	
14617	2	0.500	0.196	19,100	97,400	21,400	109,200	0.42	21.0	0.27	70.9	.06, .36*	Fine silky; cup shaped.
	4	.500	.196	18,500	94,400	21,300	108,800	.43	21.5	.27	70.9	.36*, .07	Fine silky.
	6	.500	.196	19,600	100,000	22,000	112,200	.45	22.5	.27	70.9	.15, .30*	Fine silky; serrated.
	8	.500	.196	19,200	98,000	22,000	112,200	.44	22.0	.28	67.9	.29*, .15	Do.
	10	.500	.196	19,100	97,400	22,000	112,200	.43	21.5	.28	67.9	.08, .35*	Do.
	12	.500	.196	19,200	98,000	22,300	113,800	.43	21.5	.28	67.9	.15, .28*	Fine silky; cup shaped.

TENSILE TESTS OF TWO STEEL SPECIMENS FOR COMPARISON OF THE BETHLEHEM STEEL CO.'S EMERY TESTING MACHINE.

14634	A. 4. L	0.505	0.20	11,400	57,000	17,200	86,000	0.60	30.0	0.32	59.8	.33*, .27	Fine silky; cup shaped.
	A. 5. L	.501	.197	10,800	54,800	16,800	85,300	.58	29.0	.31	61.7	.40*, .18	Do.

TENSILE TESTS OF FIVE STEEL SPECIMENS FOR COMPARISON OF THE TESTING MACHINE AT THE FEDERAL STEEL FOUNDRY CO., CHESTER, PA.

14658	1	0.505	0.20	10,500	52,500	18,300	91,500	0.47	23.5	0.40	37.1	.30*, .17	Silky.
	3	.505	.20	11,000	55,000	18,300	91,500	.46	23.0	.41	34	.23*, .23*	Do.
	5	.505	.20	10,900	54,500	18,200	91,000	.45	22.5	.42	30.7	.22*, .23*	Do.
	7	.505	.20	10,900	54,500	18,200	91,000	.48	24.0	.40	37.1	.25*, .23*	Do.
	9	.505	.20	10,500	52,500	18,200	91,000	.47	23.5	.40	37.1	.24*, .23*	Do.

TENSILE TESTS OF THREE STEEL SPECIMENS FOR COMPARISON OF THE TESTING MACHINE AT THE WORKS OF POOLE ENGINEERING CO., WOODBERRY, MD.

14671	583	0.505	0.20	10,100	50,500	17,600	88,000	0.40	20.0	0.35	51.9	.10, .30*	Fine silky.
	584	.505	.20	11,100	55,500	18,800	94,000	.47	23.5	.38	43.3	.32*, .15	Do.
	585	.505	.20	11,300	56,500	18,100	90,500	.44	22.0	.37	46.2	.11, .33*	Do.

TENSILE TEST OF FIVE STEEL SPECIMENS FOR THE COMPARISON OF THE TESTING MACHINES AT FRANKFORD ARSENAL.

TEST 9223.

Marks, No. 1.
Diameter, 0.505 in.
Sectional area, 0.20 sq. in.
Gauged length, 2 in.

Load.	Stress per sq. in.	In gauged length.		Remarks.
		Elongation.	Set.	
Lb.	*Lb.*	*In.*	*In.*	
200	1,000	0.	0.	
1,000	5,000	.0003	.....	
2,000	10,000	.0005	.....	
3,000	15,000	.0008	.....	
4,000	20,000	.0012	.....	
5,000	25,000	.0016	.....	
6,000	30,000	.0019	.....	
6,400	32,000	.0020	.....	
6,800	34,000	.0022	.....	
7,200	36,000	.0022	.....	
7,600	38,000	.0025	.....	
8,000	40,000	.0025	.....	
8,800	44,000	.0052	.0020	
9,200	46,000	.0052	.....	
9,600	48,000	.0054	.....	
10,000	50,000	.0056	.....	
10,200	51,000	.0056	.....	
10,400	52,000	.0057	.....	
10,600	53,000	.0060	.....	
10,800	54,000	.0130 .0200	.0158	
11,000	55,000	.0210	.....	
11,200	56,000	.0215	.....	
11,400	57,000	.0230	.....	
11,600	58,000	.0248	.....	
11,800	59,000	.0265	.....	
12,000	60,000	.0285	.....	
12,400	62,000	.0320	.....	
12,800	64,000	.0355	.....	
13,200	66,000	.0390	.....	
13,600	68,000	.0425	.....	
14,000	70,000	.0478	.....	
15,000	75,000	.07	.....	
16,000	80,000	.09	.....	
17,000	85,000	.11	.....	
18,000	90,000	.14	.....	
19,000	95,000	.20	.....	
19,500	97,500	.....	.....	Tensile strength.

Elongation after fracture, 0.54 in. in 2 in. = 27 per cent.
Elongation of inch sections, 0.26*, 0.28* in.
Diameter at fracture, 0.36 in.
Sectional area, 0.102 sq. in.
Contraction of area, 49.1 per cent.
Appearance of fracture, fine silky.

TEST 9224.

Marks, No. 2.
Diameter, 0.505 in.
Sectional area, 0.20 sq. in.
Gauged length, 2 in.

Load.	Stress per sq. in.	In gauged length.		Remarks.
		Elongation.	Set.	
Lb.	*Lb.*	*In.*	*In.*	
200	1,000	0.	0.	
1,000	5,000	0.	.....	
2,000	10,000	.0003	.....	
3,000	15,000	.0005	.....	
4,000	20,000	.0010	.....	
5,000	25,000	.0013	.....	
6,000	30,000	.0015	.....	
6,200	31,000	.0018	.....	
6,400	32,000	.0019	.....	
6,600	33,000	.0019	.....	
6,800	34,000	.0019	.....	
7,000	35,000	.0020	.....	
7,200	36,000	.0020	.....	
7,600	38,000	.0021	.....	
8,000	40,000	.0022	.....	
8,400	42,000	.0025	.....	
8,800	44,000	.0025	.....	
9,200	46,000	.0026	.....	
9,600	48,000	.0028	.....	
10,000	50,000	.0030	.....	
10,400	52,000	.0031	.....	
10,600	53,000	.0032	.....	
10,800	54,000	.0033	.....	
11,000	55,000	.0050 .0218	.....	
11,200	56,000	.0221	.0178	
11,600	58,000	.0260	.....	
12,000	60,000	.0295	.....	
12,400	62,000	.0330	.....	
12,800	64,000	.0360	.....	
13,200	66,000	.0400	.....	
13,600	68,000	.0440	.....	
14,000	70,000	.0490	.....	
15,000	75,000	.06	.....	
16,000	80,000	.07	.....	
17,000	85,000	.10	.....	
18,000	90,000	.12	.....	
19,000	95,000	.18	.....	
19,500	97,500	.....	.....	Tensile strength.

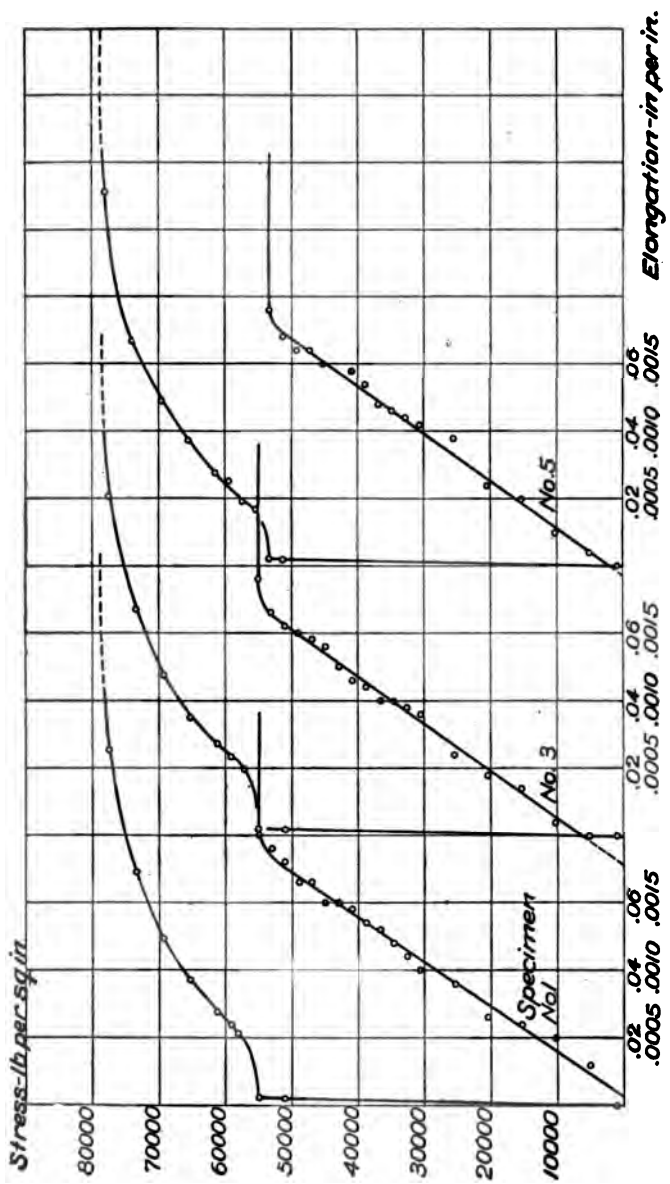
Elongation after fracture, 0.50 in. in 2 in. = 25 per cent.
Elongation of inch sections, 0.25*, 0.25* in.
Diameter at fracture, 0.37 in.
Sectional area, 0.108 sq. in.
Contraction of area, 46.2 per cent.
Appearance of fracture, fine silky.

TEST 9227.

Marks, No. 5.
Diameter, 0.505 in.
Sectional area, 0.20 sq. in.
Gauged length, 2 in.

Load.	Stress per sq. in.	In gauged length.		Remarks.
		Elongation.	Set.	
Lb.	*Lb.*	*In.*	*In.*	
200	1,000	0.	0.	
1,000	5,000	0.	0.	
2,000	10,000	.0003	.....	
3,000	15,000	.0006	.....	
4,000	20,000	.0010	.....	
5,000	25,000	.0013	.....	
6,000	30,000	.0016	.....	
6,400	32,000	.0019	.....	
6,800	34,000	.0020	.....	
7,200	36,000	.0020	.....	
7,600	38,000	.0021	.....	
8,000	40,000	.0022	.....	
8,400	42,000	.0023	.....	
8,800	44,000	.0025	.....	
9,200	46,000	.0026	.....	
9,600	48,000	.0027	.....	
10,000	50,000	.0029	.....	
10,200	51,000	.0029	.....	
10,400	52,000	.0030	.....	
10,600	53,000	.0031	.....	
10,800	54,000	.0032	−.0002	
11,000	55,000	.0034	−.0001	
11,200	56,000	.0063 .0230	.0190	
11,600	58,000	.0255	.....	
12,000	60,000	.0284	.....	
12,400	62,000	.0325	.....	
12,800	64,000	.0356	.....	
13,200	66,000	.0392	.....	
13,600	68,000	.0440	.....	
14,000	70,000	.0488	.....	
15,000	75,000	.0610	.....	
16,000	80,000	.0790	.....	
17,000	85,000	.10	.....	
18,000	90,000	.13	.....	
19,000	95,000	.20	.....	
19,300	96,500	.....	.....	Tensile strength.

Elongation after fracture, 0.54 in. in in. = 27 per cent.
Elongation of inch section, 0.25, 0.29* in.
Diameter at fracture, 0.36 in.
Sectional area, 0.102 sq. in.
Contraction of area, 49.1 per cent.
Appearance of fracture, fine silky.



Test No. 14535

Tensile tests of Steel Specimens for Standardizing Testing Machine.

Carnegie Steel Co. Pittsburg, Penn.

TEST 14535.

TENSILE TEST OF THREE STEEL SPECIMENS FOR THE COMPARISON OF THE TESTING MACHINE OF THE CARNEGIE STEEL CO., PITTSBURGH, PA.

Marks, No. 1.
Diameter, 0.504 in.
Sectional area, 0.20 sq. in.
Gauged length, 2 in.

Load.	Stress per sq. in.	In gauged length.		Remarks.
		Elongation.	Set.	
Lb.	*Lb.*	*In.*	*In.*	
204	1,020	0.	0.	
1,020	5,100	.0006	.....	
2,040	10,200	.0010	.....	
3,060	15,300	.0012	.....	
4,080	20,400	.0013	.....	
5,100	25,500	.0018	.....	
6,120	30,600	.0020	.....	
6,530	32,600	.0022	.....	
6,940	34,700	.0024	.....	
7,340	36,700	.0026	.....	
7,750	38,800	.0027	.....	
8,160	40,800	.0029	.....	
8,560	42,800	.0030	.....	
8,980	44,900	.0030	.....	
9,380	46,900	.0033	.....	
9,790	48,900	.0033	.....	
10,200	51,000	.0036	.....	Elastic limit.
10,600	53,000	.0038	.....	
11,000	55,000	.0040	.....	Yield point.
11,620	58,100	.0420	.....	
11,820	59,100	.0470	.....	
12,240	61,200	.0550	.....	
13,050	65,200	.0732	.....	
13,860	69,300	.0985	.....	
14,700	73,500	.1380	.....	
15,500	77,500	.2170	.....	
15,800	79,000	.....	.....	Tensile strength.

Elongation in 2 in., 0.61 in. = 30.5 per cent.
Elongation of inch sections, 0.40*; 0.21 in.
Diameter at fracture, 0.31 in.
Sectional area, 0.0755 sq. in.
Contraction of area, 62.2 per cent.
Appearance of fracture, fine silky, cup shaped.

Marks, No. 3.
Diameter, 0.505 in.
Sectional area, 0.20 sq. in.
Gauged length, 2 in.

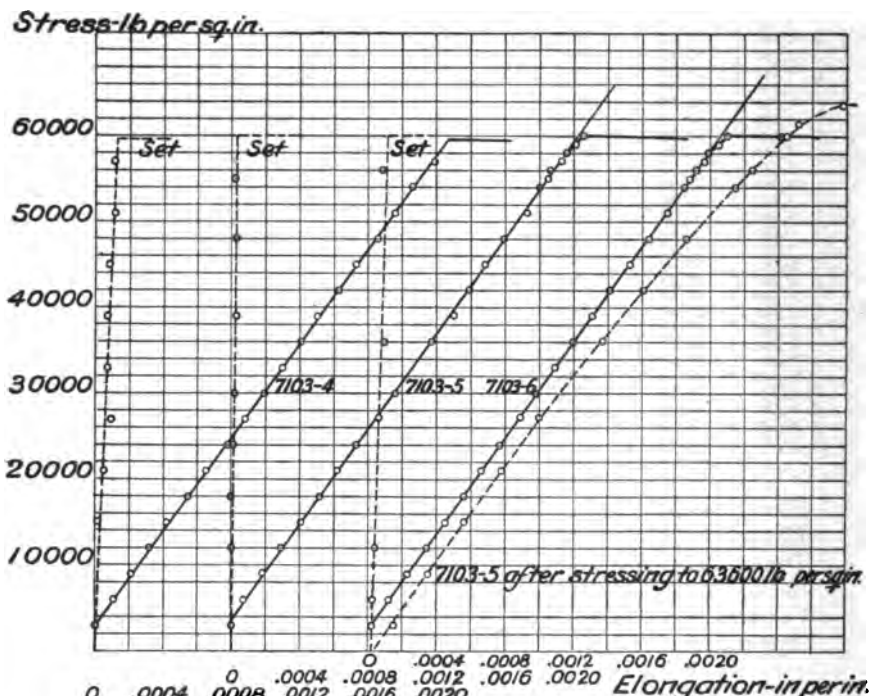
Load.	Stress per sq. in.	In gauged length.		Remarks.
		Elongation.	Set.	
Lb.	*Lb.*	*In.*	*In.*	
204	1,020	0.	0.	
1,020	5,100	0.	.....	
2,040	10,200	.0002	.....	
3,060	15,300	.0007	.....	
4,080	20,400	.0009	.....	
5,100	25,500	.0012	.....	
6,120	30,600	.0018	.....	
6,530	32,600	.0019	.....	
6,940	34,700	.0020	.....	
7,340	36,700	.0020	.....	
7,750	38,800	.0022	.....	
8,160	40,800	.0023	.....	
8,560	42,800	.0025	.....	
8,980	44,900	.0028	.....	
9,380	46,900	.0029	.....	
9,790	49,000	.0030	.....	
10,200	51,000	.0031	.....	
10,600	53,000	.0033	.....	Elastic limit.
11,000	55,000	.0038	.....	Yield point.
11,420	57,100	.0391	.....	
11,820	59,100	.0462	.....	
12,240	61,200	.0537	.....	
13,050	65,200	.0702	.....	
13,860	69,300	.0945	.....	
14,700	73,500	.1340	.....	
15,500	77,500	.2130	.....	
15,700	78,500	.....	.....	Tensile strength.

Elongation in 2 in., 0.61 in. = 30.5 per cent.
Elongation of inch sections, 0.29, 0.32* in.
Diameter at fracture, 0.31 in.
Sectional area, 0.0755 sq. in.
Contraction of area, 62.2 per cent.
Appearance of fracture, fine silky, cup shaped.

Marks, No. 5.
Diameter, 0.503 in.
Sectional area, 0.199 sq. in.
Gauged length, 2 in.

Load.	Stress per sq. in.	In gauged length.		Remarks.
		Elongation.	Set.	
Lb.	*Lb.*	*In.*	*In.*	
204	1,020	0.	0.	
1,020	5,130	.0002	.....	
2,040	10,250	.0005	.....	
3,060	15,400	.0010	.....	
4,080	20,500	.0012	.....	
5,100	25,600	.0019	.....	
6,120	30,700	.0021	.....	
6,530	32,800	.0022	.....	
6,940	34,900	.0023	.....	
7,340	36,900	.0024	.....	
7,750	38,900	.0027	.....	
8,160	41,000	.0029	.....	
8,560	43,000	.0029	.....	
8,980	45,200	.0030	.....	
9,380	47,200	.0032	.....	
9,790	49,200	.0032	.....	
10,200	51,300	.0034	.....	Elastic limit.
10,600	53,300	.0038	.....	
10,900	54,500	.....	.....	Yield point.
11,000	55,300	.0330	.....	
11,420	57,400	.0380	.....	
11,820	59,400	.0500	.....	
12,240	61,500	.0545	.....	
13,050	65,600	.0742	.....	
13,860	69,600	.0980	.....	
14,700	73,900	.1350	.....	
15,500	77,900	.2230	.....	
15,700	78,900	.....	.....	Tensile strength.

Elongation in 2 in., 0.59 in. = 29.5 per cent.
Elongation of inch sections, 0.40*, 0.19 in.
Diameter at fracture, 0.32 in.
Sectional area, 0.0804 sq. in.
Contraction of area, 59.6 per cent.
Appearance of fracture, fine silky.



Test No. 14559 Tensile Tests of Steel Specimens for Calibration of Testing Machine at Newport News Shipbuilding & Drydock Co. Newport News, Va.

TEST 14559.

TENSILE TESTS OF STEEL SPECIMENS FOR COMPARISON OF TESTING MACHINE AT NEWPORT NEWS SHIPBUILDING & DRYDOCK CO., NEWPORT NEWS, VA.

Marks, 7103–4.
Diameter, 0.798 in.
Sectional area, 0.50 sq. in.
Gauged length, 10 in.

Applied loads.		In gauged length.		In unit length per in.		Remarks.
Load.	Stress per sq. in.	Elongation.	Set.	Elongation.	Set.	
Lb.	*Lb.*	*In.*	*In.*	*In.*	*In.*	
1,500	3,000	0.	0.	0.	0.	
3,000	6,000	.0011	.....	.00011	.....	
4,500	9,000	.0021	.....	.00021	.....	
6,000	12,000	.0032	.....	.00032	.....	
7,500	15,000	.0042	.0001	.00042	.00001	
9,000	18,000	.0055	.....	.00055	.....	
10,500	21,000	.0065	.0005	.00065	.00005	
12,000	24,000	.0078	.....	.00078	.....	
13,500	27,000	.0088	.0009	.00088	.00009	
15,000	30,000	.0100	.....	.00100	.....	
16,500	33,000	.0110	.0007	.00110	.00007	
18,000	36,000	.0121	.....	.00121	.....	
19,500	39,000	.0130	.0007	.00130	.00007	
21,000	42,000	.0143	.....	.00143	.....	
22,500	45,000	.0153	.0008	.00153	.00008	
24,000	48,000	.0166	.....	.00166	.....	
25,500	51,000	.0176	.0011	.00176	.00011	
27,000	54,000	.0186	.....	.00186	.....	
28,500	57,000	.0199	.0011	.00199	.00011	
29,700	58,000	.....	.....	.....	.....	Elastic limit.
	59,400	.0700	.....	.00700	.....	Yield point.
30,000	60,000	.0734	.....	.00734	.....	
31,000	62,000	.0838	.0612	.00838	.00612	
32,000	64,000	.0980	.....	.00980	.....	
33,000	66,000	.1156	.....	.01156	.....	
52,200	104,400	.....	.....	.....	.....	Tensile strength.

Elongation after fracture, 1.72 in. in 10 in.=17.2 per cent.
Diameter at fracture, 0.55 in.
Sectional area, 0.738 sq. in.
Contraction of area, 52.4 per cent.
Appearance of fracture, silky.
Scleroscope hardness, 38.

Marks, 7103–5.
Diameter, 0.798 in.
Sectional area, 0.50 sq. in.
Gauged length, 10 in.

Applied loads.		In gauged length.		In unit length per in.		Remarks.
Load.	Stress per sq. in.	Elongation.	Set.	Elongation.	Set.	
Lb.	*Lb.*	*In.*	*In.*	*In.*	*In.*	
1,530	3,000	0.	0.	0.	0.	
2,960	6,000	.0007	.....	.00007	.....	
4,490	9,000	.0018	.....	.00018	.....	
6,020	12,000	.0029	.....	.00029	.....	
7,550	15,000	.0041	.....	.00041	.....	
8,980	18,000	.0052	.....	.00052	.....	
10,500	21,000	.0062	.....	.00062	.....	
12,000	24,000	.0073	.0001	.00073	.00001	
13,600	27,200	.0086	.....	.00086	.....	
15,000	30,000	.0096	.0002	.00096	.00002	
18,000	36,000	.0117	.....	.00117	.....	
19,500	39,000	.0130	.0003	.00130	.00003	
21,000	42,000	.0139	.....	.00139	.....	
22,500	45,000	.0148	.....	.00148	.....	
24,000	48,000	.0159	.0003	.00159	.00003	
25,500	51,000	.0173	.....	.00173	.....	
27,000	54,000	.0180	.....	.00180	.....	
27,500	55,000	.0185	.0002	.00185	.00002	
28,000	56,000	.0186	.....	.00186	.....	
28,500	57,000	.0193	.....	.00193	.....	
29,000	58,000	.0196	.....	.00196	.....	Elastic limit.
29,500	59,000	.0201	.....	.00201	.....	
30,000	60,000	.0206	.....	.00206	.....	
30,200	60,400	.....	.....	.....	.....	Yield point.
29,800	59,600	.0365	.....	.00365	.....	
30,000	60,000	.0404	.....	.00404	.....	
30,100	60,200	.0455	.....	.00455	.....	
29,700	59,400	.0510	.....	.00510	.....	
29,900	59,800	.0540	.....	.00540	.....	
30,200	60,400	.0598	.....	.00598	.....	
30,700	61,400	.0650	.....	.00650	.....	
31,000	62,000	.0710	.....	.00710	.....	
31,800	63,600	.0800	.....	.00800	.....	
1,530	3,000	.0595	.....	.00595	.....	
4,490	9,000	.0615	.....	.00615	.....	
7,550	15,000	.0636	.....	.00636	.....	
10,500	21,000	.0658	.....	.00658	.....	
13,600	27,200	.0680	.....	.00680	.....	
18,000	36,000	.0717	.....	.00717	.....	
21,000	42,000	.0741	.....	.00741	.....	
24,000	48,000	.0766	.....	.00766	.....	
27,000	54,000	.0795	.....	.00795	.....	
28,000	56,000	.0805	.....	.00805	.....	
30,000	60,000	.0822	.....	.00822	.....	
30,700	61,400	.0832	.....	.00832	.....	
31,800	63,600	.0858	.....	.00858	.....	
32,600	65,200	.0920	.....	.00920	.....	
33,700	67,400	.1106	.....	.01106	.....	
34,700	69,400	.1278	.....	.01278	.....	
52,800	105,600	.....	.....	.....	.....	Tensile strength.

Elongation after fracture, 1.63 in. in 10 in.=16.3 per cent.
Diameter at fracture, 0.56 in.
Sectional area, 0.246 sq. in.
Contraction of area, 50.8 per cent.
Appearance of fracture, silky.
Scleroscope hardness, 37.

Marks, 7103–6.
Diameter, 0.798 in.
Sectional area, 0.50 sq. in.
Gauged length, 10 in.

Applied loads.		In gauged length.		In unit length per in.		Remarks.
Load.	Stress per sq. in.	Elongation.	Set.	Elongation.	Set.	
Lb.	*Lb.*	*In.*	*In.*	*In.*	*In.*	
1,530	3,000	0.0002	0.0002	0.00002	0.00002	
2,960	6,000	.0012	.0003	.00012	.00003	
4,490	9,000	.0023	.....	.00023	.....	
6,020	12,000	.0034	.0004	.00034	.00004	
7,550	15,000	.0045	.....	.00045	.....	
8,980	18,000	.0056	.....	.00056	.....	
10,500	21,000	.0066	.....	.00066	.....	
12,000	24,000	.0077	.....	.00077	.....	
13,600	27,200	.0089	.....	.00089	.....	
15,000	30,000	.0098	.....	.00098	.....	
16,500	33,000	.0109	.....	.00109	.....	
18,000	36,000	.0120	.0010	.00120	.00010	
19,500	39,000	.0131	.....	.00131	.....	
21,000	42,000	.0141	.....	.00141	.....	
22,500	45,000	.0153	.....	.00153	.....	
24,000	48,000	.0164	.....	.00164	.....	
25,500	51,000	.0175	.....	.00175	.....	
27,000	54,000	.0185	.....	.00185	.....	
27,500	55,000	.0188	.....	.00188	.....	
28,000	56,000	.0192	.0009	.00192	.00009	
29,000	58,000	.0199	.....	.00199	.....	Elastic limit.
29,500	59,000	.0205	.....	.00205	.....	
		.0210	.....	.00210	.....	
30,000	60,000	.0245	.....	.00245	.....	Yield point.
		.0279	.....	.00279	.....	
30,200	60,400	.0320	.....	.00320	.....	
52,600	105,200	.....	.....	.....	.....	Tensile strength.

Elongation after fracture, 1.74 in. in 10 in. = 17.4 per cent.
Diameter at fracture, 0.56 in.
Sectional area, 0.246 sq. in.
Contraction of area, 50.8 per cent.
Appearance of fracture, silky.
Scleroscope hardness, 37.

Tensile tests of Steel Specimens for Calibration of Testing Machine at Midvale Steel Company.

TEST 14621.

TENSILE TESTS OF STEEL SPECIMENS FOR THE COMPARISON OF THE TESTING MACHINE AT MIDVALE STEEL CO.

Marks, 5/3161–4.
Diameter, 0.505 in.
Sectional area, 0.20 sq. in.
Gauged length, 2 in.

Load.	Stress per square inch.	In gauged length.		In unit length per inch.		Remarks.
		Elongation.	Set.	Elongation.	Set.	
Lb.	*Lb.*	*In.*	*In.*	*In.*	*In.*	
1,000	5,000	0.	0.	0.	0.	
2,000	10,000	.0001	.....	.00005	.....	
3,000	15,000	.0004	.....	.00020	.....	
4,000	20,000	.0009	.....	.00045	.....	
5,000	25,000	.0012	.....	.00060	.....	
6,000	30,000	.0015	.....	.00075	.....	
7,000	35,000	.0017	.....	.00085	.....	
8,000	40,000	.0021	.....	.00105	.....	
9,000	45,000	.0025	.....	.00125	.....	
10,000	50,000	.0029	− .0002	.00145	− .00010	
11,000	55,000	.0032	.....	.00160	.....	
12,000	60,000	.0035	.....	.00175	.....	
12,200	61,000	.0036	− .0002	.00180	− .00010	
12,400	62,000	.0036	.....	.00180	.....	
12,600	63,000	.0037	.....	.00185	.....	
12,800	64,000	.0038	.....	.00190	.....	
13,000	65,000	.0039	.....	.00195	.....	
13,200	66,000	.0040	.....	.00200	.....	
13,400	67,000	.0060	.....	.00300	.....	Yield point.
		.0280	.....	.01400	.....	
13,600	68,000	.0285	.....	.0143	.....	
13,800	69,000	.0296	.....	.0148	.....	
14,000	70,000	.0312	.....	.0156	.....	
20,000	100,000	.....	.....	.....	.....	Tensile strength.

Elongation after fracture, 0.54 in. in 2 in. = 27 per cent.
Elongation of inch sections, 0.16, 0.38* in.
Diameter at fracture, 0.31 in.
Sectional area, 0.755 sq. in.
Contraction of area, 62.2 per cent.
Appearance of fracture, fine silky.

Marks, 5/3161–7.
Diameter, 0.505 in.
Sectional area, 0.20 sq. in.
Gauged length, 2 in.

Load.	Stress per square inch.	In gauged length.		In unit length per inch.		Remarks.
		Elongation.	Set.	Elongation.	Set.	
Lb.	*Lb.*	*In.*	*In.*	*In.*	*In.*	
1,000	5,000	0.0001	.....	0.00005	.....	
2,000	10,000	.0003	.....	.00015	.....	
3,000	15,000	.0006	.....	.00030	.....	
4,000	20,000	.0009	.....	.00045	.....	
5,000	25,000	.0012	.....	.00060	.....	
6,000	30,000	.0016	.....	.00080	.....	
7,000	35,000	.0019	.....	.00095	.....	
8,000	40,000	.0022	.....	.00110	.....	
9,000	45,000	.0026	.....	.00130	.....	
10,000	50,000	.0029	.....	.00145	.....	
11,000	55,000	.0033	.....	.00165	.....	
12,000	60,000	.0037	.....	.00185	.....	
12,200	61,000	.0036	.....	.00180	.....	
12,400	62,000	.0037	.....	.00185	.....	
12,600	63,000	.0039	.....	.00195	.....	
12,800	64,000	.0040	.....	.00200	.....	
13,000	65,000	.0040	.....	.00200	.....	
13,200	66,000	.0041	.....	.00205	.....	
13,400	67,000	.0041	.....	.00205	.....	Yield point.
		.0065	.....	.00325	.....	
13,600	68,000	.0296	.....	.0148	.....	
13,800	69,000	.0320	.....	.0160	.....	
14,000	70,000	.0322	.....	.0161	.....	
20,100	100,500	.....	.....	.....	.....	Tensile strength.

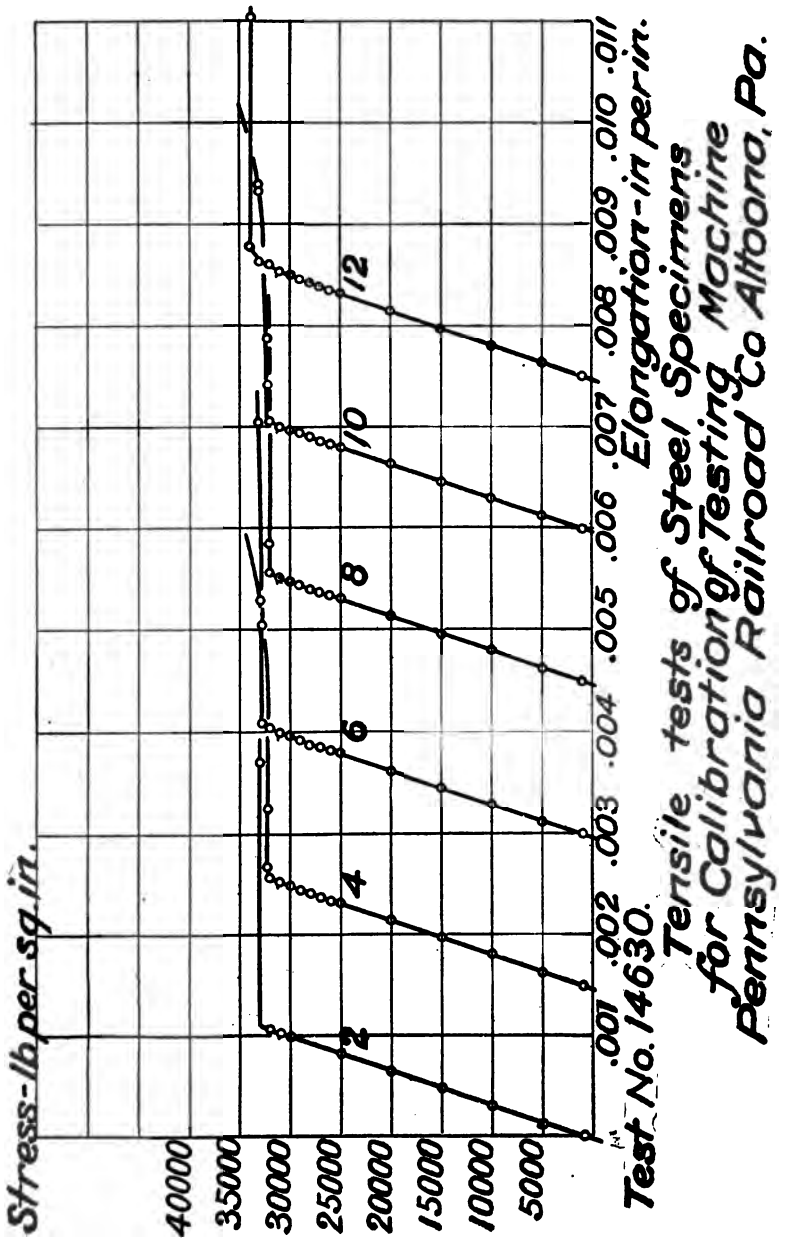
Elongation after fracture, 0.50 in. in 2 in.=25 per cent.
Elongation of inch sections, 0.12, 0.38* in.
Diameter at fracture, 0.31 in.
Sectional area, 0.0755 sq. in.
Contraction of area, 62.2 per cent.
Appearance of fracture, silky, cup shaped.

Marks, 5/3161–9.
Diameter, 0.505 in.
Sectional area, 0.20 sq. in.
Gauged length, 2 in.

Load.	Stress per square inch.	In gauged length.		In unit length per inch.		Remarks.
		Elongation.	Set.	Elongation.	Set.	
Lb.	*Lb.*	*In.*	*In.*	*In.*	*In.*	
1,000	5,000	0.	.....	0.	.....	
2,000	10,000	.0003	.....	.00015	.....	
3,000	15,000	.0006	.....	.00030	.....	
4,000	20,000	.0009	.....	.00045	.....	
5,000	25,000	.0013	.....	.00065	.....	
6,000	30,000	.0016	.....	.00080	.....	
7,000	35,000	.0020	.....	.00100	.....	
8,000	40,000	.0021	.....	.00105	.....	
9,000	45,000	.0026	.....	.00130	.....	
10,000	50,000	.0030	.....	.00150	.....	
11,000	55,000	.0034	.....	.00170	.....	
12,000	60,000	.0035	.0004	.00175	.00020	
12,200	61,000	.0040	.....	.00200	.....	
12,400	62,000	.0041	.....	.00205	.....	
12,600	63,000	.0041	.....	.00205	.....	
12,800	64,000	.0042	.....	.00210	.....	
13,000	65,000	.0043	.....	.00215	.....	
13,200	66,000	.0070	.....	.0035	.....	Yield point.
		.0252	.....	.0126	.....	
13,400	67,000	.0266	.....	.0133	.....	
13,600	68,000	.0280	.....	.0140	.....	
13,800	69,000	.0290	.....	.0145	.....	
14,000	70,000	.0315	.....	.01575	.....	
20,000	100,000	.....	.....	.....	.....	Tensile strength.

Elongation after fracture, 0.52 in. in 2 in. = 26 per cent.
Elongation of inch sections, 0.32; 0.20 in.
Diameter at fracture, 0.31 in.
Sectional area, 0.0755 sq. in.
Contraction of area, 62.2 per cent.
Appearance of fracture, fine silky.

Marks		5/3161–15.	5/3161–17.
Diameter	in.	0.505	0.505
Sectional area	sq. in.	0.20	0.20
Elastic limit, load	lb.	13,500	14,000
Elastic limit, stress	per sq. in. lb.	67,500	70,000
Tensile strength, load	lb.	19,800	19,900
Tensile strength, stress	per sq. in. lb.	99,000	99,500
Elongation in 2 in.	in.	0.52	0.53
Elongation in 2 in.	per cent.	26	26.5
Elongation of inch sections	in.	.13, .39*	.32*, .21
Diameter at fracture	in.	0.31	0.31
Contraction of area	per cent.	62.2	62.2
Appearance of fracture		Fine silky.	Fine silky.


Stress-lb per sq.in.
40000
35000
30000
25000
20000
15000
10000
5000
.001 .002 .003 .004 .005 .006 .007 .008 .009 .010 .011
Elongation-in per in.
2
4
6
8
10
12
Test No. 14630.
Tensile tests of Steel Specimens
for Calibration of Testing Machine
Pennsylvania Railroad Co Altoona, Pa.

TEST 14630.

TENSILE TEST OF SIX STEEL SPECIMENS FOR COMPARISON OF THE TESTING MACHINE OF THE PENNSYLVANIA RAILROAD CO., ALTOONA, PA.

Specimens marked 2–4–6–8–10–12.

Marks, 2.
Diameter, 0.798 in.
Sectional area, 0.50 sq. in.
Gauged length, 10 in.

Applied loads.		In gauged length.		Per inch.		Remarks.
Total.	Per square inch.	Elongation.	Set.	Elongation.	Set.	
Lb.	*Lb.*	*In.*	*In.*	*In.*	*In.*	
500	1,000	0.	0.	0.	.....	
2,500	5,000	.0013	.....	.00013	.....	
5,000	10,000	.0030	.....	.00030	.....	
7,500	15,000	.0048	.....	.00048	.....	
10,000	20,000	.0064	.....	.00064	.....	
12,500	25,000	.0081	.....	.00081	.....	
15,000	30,000	.0099	.....	.00099	.....	
15,500	31,000	.0102	.....	.00102	.....	
16,000	32,000	.0106	.....	.00106	.....	
16,500	33,000	.0370 .0560	.....	.00370 .00560	.....	
17,000	34,000	.1680	.....	.01680	.....	
25,300	50,600	.....	.....	.....	.....	Tensile strength.

Elongation after fracture, 3.10 in. in 10 in. = 31 per cent.
Elongation of inch sections, 0.24, 0.26, 0.29, 0.29, 0.37, 0.73*, 0.28, 0.25, 2.71 in. in 8 in. = 33.9 per cent.
Diameter at fracture, 0.42 in.
Sectional area, 0.139 sq. in.
Contraction of area, 72.2 per cent.
Position of fracture, 5 in. from the neck.
Appearance of fracture, silky. Scleroscope hardness, 28.

Marks, 4.
Diameter, 0.798 in.
Sectional area, 0.50 sq. in.
Gauged length, 10 in.

Applied loads.		In gauged length.		Per inch.		Remarks.
Total.	Per square inch.	Elongation.	Set.	Elongation.	Set.	
Lb.	*Lb.*	*In.*	*In.*	*In.*	*In.*	
500	1,000	0.	0.	0.	0.	
2,500	5,000	.0012	.....	.00012	.....	
5,000	10,000	.0030	.....	.00030	.....	
7,500	15,000	.0047	.....	.00047	.....	
10,000	20,000	.0064	.....	.00064	.....	
12,500	25,000	.0081	.....	.00081	.....	
13,000	26,000	.0084	.....	.00084	.....	
13,500	27,000	.0087	.....	.00087	.....	
14,000	28,000	.0091	.....	.00091	.....	
14,500	29,000	.0094	.....	.00094	.....	
15,000	30,000	.0099	.....	.00099	.....	
15,500	31,000	.0102	.....	.00102	.....	
16,000	32,000	.0106	.....	.00106	.....	
16,100	32,200	.0118 .0175	....	.00118 .00175	....	Yield point.
16,500	33,000	.0380	.....	.00380	.....	
17,000	34,000	.1230	.....	.01230	.....	
25,300	50,600	.....	.....	.....	.....	Tensile strength.

Elongation after fracture, 3.10 in. in 10 in. = 31 per cent.
Elongation of inch sections, 0.24, 0.27, 0.28, 0.39, 0.75*, 0.30, 0.27, 0.24, 2.74 in. in 8 in. = 33 per cent.
Diameter at fracture, 0.41 in.
Sectional area, 0.132 sq. in.
Contraction of area, 73.6 per cent.
Position of fracture, at the middle.
Appearance of fracture, silky. Scleroscope hardness, 28.

Marks, 6.
Diameter, 0.798 in.
Sectional area, 0.50 sq. in.
Gauged length, 10 in.

Applied loads.		In gauged length.		Per inch.		Remarks.
Total.	Per square inch.	Elongation.	Set.	Elongation.	Set.	
Lb.	*Lb.*	*In.*	*In.*	*In.*	*In.*	
500	1,000	0.	0.	0.	0.	
2,500	5,000	.0012	−.0001	.00012	−.00001	
5,000	10,000	.0029	.....	.00029	.....	
7,500	15,000	.0046	.....	.00046	.....	
10,000	20,000	.0062	.....	.00062	.....	
12,500	25,000	.0079	.....	.00079	.....	
13,000	26,000	.0081	.....	.00081	.....	
13,500	27,000	.0085	.....	.00085	.....	
14,000	28,000	.0087	.....	.00087	.....	
14,500	29,000	.0091	.....	.00091	.....	
15,000	30,000	.0096	.....	.00096	.....	
15,500	31,000	.0099	.....	.00099	.....	
16,000	32,000	.0104	.....	.00104	.....	
16,400	32,800	.0109 .0205	.....	.00109 .00205	.....	Yield point.
16,500	33,000	.0405	.....	.00405	.....	
17,000	34,000	.31	.....	.031	.....	
25,300	50,600	.....	.....	.....	.....	Tensile strength.

Elongation after fracture, 3.33 in. in 10 in. = 33.3 per cent.
Elongation of inch sections, 0.28, 0.32, 0.35, 0.32, 0.63*, 0.52, 0.29, 0.25, 2.96 in. in 8 in. = 37 per cent.
Diameter at fracture, 0.41 in.
Sectional area, 0.132 sq. in.
Contraction of area, 73.6 per cent.
Position of fracture, 5.50 in. from the neck.
Appearance of fracture, silky. Scleroscope hardness, 28.

Marks, 8.
Diameter, 0.798 in.
Sectional area, 0.50 sq. in.
Gauged length, 10 in.

Applied loads.		In gauged length.		Per inch.		Remarks.
Total.	Per square inch.	Elongation.	Set.	Elongation.	Set.	
Lb.	*Lb.*	*In.*	*In.*	*In.*	*In.*	
500	1,000	0.	0.	0.	0.	
2,500	5,000	.0012	−.0001	.00012	−.00001	
5,000	10,000	.0030	.....	.00030	.....	
7,500	15,000	.0046	.....	.00046	.....	
10,000	20,000	.0064	.....	.00064	.....	
12,500	25,000	.0081	.....	.00081	.....	
13,000	26,000	.0084	.....	.00084	.....	
13,500	27,000	.0087	.....	.00087	.....	
14,000	28,000	.0090	.....	.00090	.....	
14,500	29,000	.0094	.....	.00094	.....	
15,000	30,000	.0097	.....	.00097	.....	
15,500	31,000	.0101	.....	.00101	.....	
16,000	32,000	.0106	.....	.00106	.....	Yield point.
		.0135	.....	.00135	.....	
16,500	33,000	.0490	.....	.00490	.....	
17,000	34,000	.29	.....	.029	.....	
17,500	35,000	.31	.....	.031	.....	
25,400	50,800	.....	.....	.....	.....	Tensile strength.

Elongation after fracture, 3.26 in. in 10 in. = 32.6 per cent.
Elongation of inch sections, 0.25, 0.29, 0.33, 0.79, 0.37, 0.30, 0.30, 0.26, 2.89 in. in 8 in. = 36.1 per cent.
Diameter at fracture, 0.41 in.
Sectional area, 0.132 sq. in.
Contraction of area, 73.6 per cent.
Position of fracture, 6.25 in. from the neck.
Appearance of fracture, silky, cup shaped. Scleroscope hardness, 28.

Marks, 10.
Diameter, 0.798 in.
Sectional area, 0.50 sq. in.
Gauged length, 10 in.

Applied loads.		In gauged length.		Per inch.		Remarks.
Total.	Per square inch.	Elongation.	Set.	Elongation.	Set.	
Lb.	*Lb.*	*In.*	*In.*	*In.*	*In.*	
500	1,000	0.	0.	0.	0.	
2,500	5,000	.0013	.....	.00013	.....	
5,000	10,000	.0030	.....	.00030	.....	
7,500	15,000	.0046	.....	.00046	.....	
10,000	20,000	.0064	.....	00064	.....	
12,500	25,000	.0080	.....	.00080	.....	
13,000	26,000	.0083	.....	.00083	.....	
13,000	27,000	.0086	.....	.00086	.....	
14,000	28,000	.0090	.....	.00090	.....	
14,500	29,000	.0094	.....	.00094	.....	
15,000	30,000	.0097	.....	.00097	.....	
15,500	31,000	.0100	.....	.00100	.....	
16,000	32,000	.0106	.....	.00106	.....	
16,100	32,200	.0142	.....	.00142	.....	Yield point.
		.0187	.....	.00187	.....	
16,500	33,000	.0332	.....	.00332	.....	
17,000	34,000	.1560	.....	.01560	.....	
17,500	35,000	.32	.....	.032	.....	
25,300	50,600	.....	.....	.....	.....	Tensile strength.

Elongation after fracture, 3.13 in. in 10 in. = 31.3 per cent.
Elongation of inch sections, 0.24, 0.27, 0.29, 0.72*, 0.46, 0.28, 0.26, 0.24, 2.76 in. in 8 in. = 34.5 per cent.
Diameter at fracture, 0.42 in.
Sectional area, 0.139 sq. in.
Contraction of area, 72.2 per cent.
Position of fracture, at the middle.
Appearance of fracture, silky. Scleroscope hardness, 28.5.

Marks, 12.
Diameter, 0.798 in.
Sectional area, 0.50 sq. in.
Gauged length, 10 in.

Applied loads.		In gauged length.		Per inch.		Remarks.
Total.	Per square inch.	Elongation.	Set.	Elongation.	Set.	
Lb.	*Lb.*	*In.*	*In.*	*In.*	*In.*	
500	1,000	0.	0.	0.	0.	
2,500	5,000	.0014	.....	.00014	.....	
5,000	10,000	.0030	.....	.00030	.....	
7,500	15,000	.0048	.....	.00048	.....	
10,000	20,000	.0066	.....	.00066	.....	
12,500	25,000	.0083	.....	.00083	.....	
13,000	26,000	.0085	.....	.00085	.....	
13,500	27,000	.0089	.....	.00089	.....	
14,000	28,000	.0093	.....	.00093	.....	
14,500	29,000	.0096	.....	.00096	.....	
15,000	30,000	.0100	.....	.00100	.....	
15,500	31,000	.0104	.....	.00104	.....	
16,000	32,000	.0110	.....	.00110	.....	
16,500	33,000	.0114	.....	.00114	.....	
16,900	33,800	.0128	.....	.00128	.....	Yield point.
		.0360	.....	.00360	.....	
17,000	34,000	.1080	.....	.01080	.....	
17,500	35,000	.29	.....	.029	.....	
18,000	36,000	.30	.....	.030	.....	
25,400	50,800	.....	.....	.....	.....	Tensile strength.

Elongation after fracture, 3.14 in. in 10 in. = 31.4 per cent.
Elongation of inch sections, 0.24, 0.28, 0.32, 0.39, 0.75*, 0.30, 0.26, 0.24, 2.78 in. in 8 in. = 34.8 per cent.
Diameter at fracture, 0.41 in.
Sectional area, 0.132 sq. in.
Contraction of area, 73.6 per cent.
Position of fracture, 6.25 in. from the neck.
Appearance of fracture, silky. Scleroscope hardness, 28.

COPPER CYLINDERS FOR COMPARISON OF DYNAMOMETERS.

TEST 14586.

COMPRESSION TEST OF 60 SMALL-ARMS COPPER CYLINDERS FOR THE PURPOSE OF COMPARISON OF THE DYNAMOMETER AT THE FRANKFORD ARSENAL WITH THE TESTING MACHINE AT WATERTOWN ARSENAL.

Number of cylinder.	Length.		Change in length.	Initial compression per sq. in. of piston area.	Length of time required to compress.
	Before compression.	After compression.			
	In.	*In.*	*In.*	*Lb.*	*Sec.*
1	0.4002	0.3525	0.0477	44,000	20
2	.4002	.3529	.0473	.....	20
3	.4003	.3532	.0471	.....	33
4	.4002	.3526	.0476	.....	22
5	.4002	.3525	.0477	.....	24
6	.4002	.3531	.0471	.....	26
7	.4001	.3510	.0491	.....	22
8	.4000	.3528	.0472	.....	24
9	.4001	.3522	.0479	.....	17
10	.4001	.3522	.0479	.....	22
11	.4000	.3520	.0480	.....	18
12	.4001	.3530	.0471	.....	14
13	.4002	.3536	.0466	.....	31
14	.4000	.3543	.0457	.....	17
15	.4002	.3518	.0484	.....	37
16	.4001	.3523	.0478	.....	20
17	.4001	.3538	.0463	.....	25
18	.4001	.3523	.0478	.....	17
19	.4001	.3539	.0462	.....	18
20	.4001	.3541	.0460	.....	24
Average	.....	.....	.0473	.....	22.5
1	.4002	.3495	.0507	46,000	24
2	.4001	.3484	.0517	.....	34
3	.4002	.3482	.0520	.....	16
4	.4002	.3478	.0524	.....	20
5	.4001	.3504	.0497	.....	19
6	.4002	.3496	.0506	.....	20
7	.4001	.3483	.0518	.....	24
8	.4001	.3491	.0510	.....	17
9	.4001	.3500	.0501	.....	19
10	.4001	.3498	.0503	.....	26
11	.4003	.3483	.0520	.....	22
12	.4001	.3505	.0496	.....	20
13	.4001	.3496	.0505	.....	28
14	.4005	.3500	.0505	.....	19
15	.4002	.3497	.0505	.....	20
16	.4004	.3467	.0537	.....	22
17	.4001	.3480	.0521	.....	17
18	.4001	.3495	.0506	.....	17
19	.4001	.3487	.0514	.....	25
20	.4001	.3510	.0491	.....	14
Average	.....	.....	.0510	.....	21.15
1	.4001	.3453	.0548	48,000	19
2	.4001	.3462	.0539	.....	23
3	.4002	.3433	.0569	.....	22
4	.4002	.3453	.0549	.....	21
5	.4002	.3439	.0563	.....	28
6	.4002	.3431	.0571	.....	19
7	.4001	.3420	.0581	.....	24
8	.4003	.3433	.0570	.....	20
9	.4001	.3452	.0549	.....	15
10	.4002	.3440	.0562	.....	19
11	.4001	.3451	.0550	.....	20
12	.4002	.3429	.0573	.....	13
13	.4002	.3451	.0551	.....	22
14	.4001	.3429	.0572	.....	20
15	.4001	.3430	.0571	.....	30
16	.4001	.3447	.0554	.....	22
17	.4001	.3440	.0561	.....	21
18	.4002	.3446	.0556	.....	22
19	.4009	.3464	.0545	.....	20
20	.4001	.3438	.0563	.....	15
Average	.....	.....	.0560	.....	20.75

CORDAGE.

MANILA ROPE.

TEST 14646.

TENSILE TESTS OF THREE-STRAND MANILA ROPE FOR WATERTOWN ARSENAL.

Samples prepared for testing with eye splices at the ends. Splices wet six hours before testing. Length between splices 6 ft.

Length of sample.	Weight of sample.	Nominal diameter.	Actual circumference.	Diameter.	Sectional area.	Tensile strength.		Parted.
						Load.	Stress per square inch.	
Ft. in.	*Lb.*	*In.*	*In.*	*In.*	*Sq. in.*	*Lb.*	*Lb.*	
18 0½	26	2⅛	7.15 to 7.40	2.40 to 2.47	4.52	31,400	6,950	1 strand at end of splice.
18 2	35	2⅜	9.05 to 9.38	3.00 to 3.25	7.07	59,500	8,420	1 strand 24 in. from the splice.

Rope 2⅛ in. diameter.

Under a load of 1,190 lb. the diameter was 2.35 in. Sectional area 4.34 sq. in. Tensile strength computed by using this sectional area, 7,230 lb. per sq. in. Circumference measured with a strip of paper about 0.5 in. wide, 6.90 in. Breaking length, 21,800 ft.

Rope 2⅜ in. diameter.

Under a load of 1,960 lb. the diameter was 2.80 in. Sectional area 6.16 sq. in. Tensile strength computed by using this sectional area 9,660 lb. per sq. in. Circumference measured with a strip of paper 8.20 in. Breaking length, 30,800 ft.

TEST 14664.

TENSILE TESTS OF TWO SAMPLES OF THREE-STRAND MANILA ROPE FOR WATERTOWN ARSENAL, MASS.

Samples prepared for testing with eye splices at the ends. Splices wet five hours before testing. Length between splices, 5 ft. and 5 ft. 9 in.

Length of sample.	Weight of sample.	Breaking length.	Nominal circumference.	Actual—		Sectional area.	Tensile strength.		Parted.
				Circumference.	Diameter.		Load.	Stress per square inch.	
Ft. in.	*Lb.*	*Ft.*	*In.*	*In.*	*In.*	*Sq. in.*	*Lb.*	*Lb.*	
18 1½	34¼	29,200	8	9.00–9.65	3.02–3.17	7.16	56,800	7,930	1 strand at the splice.
17 9¼	34¼	26,700	8	9.20–9.63	3.07–3.17	7.40	52,700	7,140	Do.

RUBBER.

TEST 14654.

TENSILE TESTS OF RUBBER FOR WATERTOWN ARSENAL—COVERING RUBBER.

Length of sample = 10 in.
Elongations taken on gauged length of 2 in.

Marks.	Width.	Thickness.	Sectional area.	Tensile strength.		Elongations in 2 in.	
				Load.	Stress per sq. in.		
	In.	*In.*	*Sq. in.*	*Lb.*	*Lb.*	*In.*	*Per cent.*
½ in. thick	0.90	0.47	0.422	227	538	2.50	125
7/16 in. thick	.93	.47	.438	199	454	2.85	142

BROWN AND BLUE PRINT PAPER.

TEST 14645.

BROWN PRINT PAPER.

Strips 1 in. wide were cut from the paper in the rolling direction and tested, holding in wood clamps with 3 inches between clamps.

Marks.	Thickness.	Sectional area.	Ultimate strength.	
			Load.	Stress per sq. in.
	In.	*Sq. in.*	*Lb. oz.*	*Lb.*
A	0.0031	0.0031	21 7.5	6,920
	.0031	.0031	20 12.0	6,700
	.0031	.0031	17 15.0	5,780
	.0031	.0031	18 11.5	6,040
Average stress				6,360
C	.0030	.0030	19 2.0	6,370
	.0030	.0030	20 3.0	6,720
	.0030	.0030	18 8.5	6,180
	.0030	.0030	20 11.5	6,910
Average stress				6,545
B	.0027	.0027	17 2.5	6,360
	.0027	.0027	18 8.5	6,860
	.0027	.0027	18 8.5	6,860
	.0027	.0027	15 9.0	5,760
Average stress				6,460
D	.0029	.0029	19 9.0	6,740
	.0029	.0029	19 7.0	6,700
	.0029	.0029	20 6.5	7,040
	.0029	.0029	20 2.5	6,950
Average stress				6,860
E	.0033	.0033	19 10.0	5,940
	.0033	.0033	19 5.0	5,850
	.0033	.0033	20 5.0	6,160
	.0033	.0033	20 9.0	6,230
Average stress				6,045

Tensile strength required, 7,000 lb. per sq. in.
Thickness required, about 0.0030 in.

Blue Print Paper.

Samples 1 in. wide obtained in same manner as brown print samples.

Marks.	Thickness.	Sectional area.	Ultimate strength.	
			Load.	Stress per sq. in.
	In.	*Sq. in.*	*Lb. oz.*	*Lb.*
F	0.0046	0.0046	29 14.5	6,500
	.0046	.0046	26 9.5	5,780
	.0046	.0046	24 7.5	5,310
	.0046	.0046	24 6.5	5,300
Average stress				5,720
G	.0051	.0051	25 13.0	5,060
	.0051	.0051	27 3.0	5,320
	.0051	.0051	24 7.0	4,790
	.0051	.0051	25 7.5	4,990
Average stress				5,040
B	.0053	.0053	22 1.5	4,100
	.0053	.0053	22 1.5	4,160
	.0053	.0053	22 10.5	4,270
	.0053	.0053	18 3.5	3,430
Average stress				4,010
H	.0050	.0050	22 3.0	4,430
	.0050	.0050	23 13.0	4,760
	.0050	.0050	22 11.0	4,530
	.0050	.0050	22 7.0	4,490
Average stress				4,550
A	.0049	.0049	27 6.0	5,580
	.0049	.0049	26 4.5	5,360
	.0049	.0049	26 6.0	5,380
	.0049	.0049	26 5.0	5,370
Average stress				5,420

Tensile strength required, 5,000 lb. per sq. in.
Thickness required, about 0.0042 in.

PRIVATE TESTS.

PRIVATE TESTS.

TESTS MADE FOR PRIVATE PARTIES DURING THE FISCAL YEAR ENDED JUNE 30, 1911.

Date.	Material.	Name.	City and State.
1910.			
July 1	Riveted joints	Pennsylvania R. R. Co	Altoona, Pa.
2	do	do	Do.
5	do	do	Do.
6	Steel eyebars	A. H. Emery	Stamford, Conn.
7	do	do	Do.
8	do	do	Do.
8	Concrete cubes	Simpson Bros. Corporation	Boston, Mass.
9	Steel	Wyman & Gordon Co	Worcester, Mass.
9	Steel eyebars	A. H. Emery	Stamford, Conn.
11	Concrete building blocks.	Building Inspector	Chelsea, Mass.
12	Granite	W. O. Crosby	Boston, Mass.
14	Manila rope	Columbian Rope Co	Auburn, N. Y.
18	Steel eyebars	A. H. Emery	Stamford, Conn.
19	do	do	Do.
19	Taylor iron	B. M. Jones & Co	Boston, Mass.
19	Clamps for forms for concrete columns.	H. P. Converse & Co	Do.
20	Steel eyebars	A. H. Emery	Stamford, Conn.
21	do	do	Do.
21	Concrete brick	F. W. Fletcher	Auburndale, Mass.
21	Riveted joints	Pennsylvania R. R. Co	Altoona, Pa.
22	do	do	Do.
22	Steel eyebars	A. H. Emery	Stamford, Conn.
23	do	do	Do.
25	do	do	Do.
26	do	do	Do.
27	do	do	Do.
28	do	do	Do.
29	do	do	Do.
30	do	do	Do.
Aug. 1	do	do	Do.
2	do	do	Do.
3	do	do	Do.
4	do	do	Do.
4	Steel	Wyman & Gordon Co	Worcester, Mass.
5	Steel eyebars	A. H. Emery	Stamford, Conn.
6	do	do	Do.
8	Marble	W. O. Crosby	Boston, Mass.
8	Concrete building blocks.	Andrew Jensen	Natick, Mass.
9	Cast iron	Davis & Farnum Co	Waltham, Mass.
11	Steel	Wyman & Gordon Co	Worcester, Mass.
11	Chain	H. I. Crandall & Son Co	East Boston, Mass.
11	Riveted joints	Pennsylvania R. R. Co	Altoona, Pa.
12	do	do	Do.
13	do	do	Do.
15	do	do	Do.
16	do	do	Do.
17	do	do	Do.
18	do	do	Do.
19	Steel	A. H. Emery	Stamford, Conn.
19	Riveted joints	Pennsylvania R. R. Co	Altoona, Pa.
20	do	do	Do.
22	do	do	Do.
22	Steel	do	Do.
23	do	Wyman & Gordon Co	Worcester, Mass.
23	Riveted joints	Pennsylvania R. R. Co	Altoona, Pa.
24	Steel	do	Do.
24	Riveted joints	The Atlantic Works	East Boston, Mass.
25	Steel	Wyman & Gordon Co	Worcester, Mass.
25	do	Pennsylvania R. R. Co	Altoona, Pa.
26	Concrete building blocks.	Charles Rossler	Buffalo, N. Y.
26	Column caps	United States Column Co	Cambridge, Mass.
26	Babbitt metal	Nassau Smelting & Refining Co	New York, N. Y.
29	Steel	Pennsylvania R. R. Co	Altoona, Pa.

Tests made for private parties during the fiscal year ended June 30, 1911—Continued.

Date.	Material.	Name.	City and State.
1910.			
Aug. 29	Steel eyebars	A. H. Emery	Stamford, Conn.
30	do	do	Do.
31	do	do	Do.
31	Steel	Wyman & Gordon Co	Worcester, Mass.
Sept. 1	Steel eyebars	A. H. Emery	Stamford, Conn.
1	Steel	Pennsylvania R. R. Co	Altoona, Pa.
2	do	do	Do.
2	Steel eyebars	A. H. Emery	Stamford, Conn.
3	do	do	Do.
6	do	do	Do.
7	do	do	Do.
8	do	do	Do.
9	do	do	Do.
10	do	do	Do.
7	Aluminum and bronze	Lightning Hose Coupling Co	Winchester, Mass.
7	Steel	Wyman & Gordon Co	Worcester, Mass.
12	Concrete building block.	Delfino Dieco	Haverhill, Mass.
12	Sewer pipe	Eastern Clay Goods Co	Boston, Mass.
13	Steel	Wyman & Gordon Co	Worcester, Mass.
13	Light vessel shackles	Fletcher & Crowell Co	Portland, Me.
13	Steel eyebars	A. H. Emery	Stamford, Conn.
14	do	do	Do.
15	do	do	Do.
16	do	do	Do.
17	do	do	Do.
19	do	do	Do.
20	do	do	Do.
21	do	do	Do.
22	do	do	Do.
22	Rubber belting	Peerless Rubber Co	New York, N. Y.
23	Hollow brick	C. H. Spring Co	Newton Lower Falls, Mass.
23	Riveted joints	A. D. Flynn	New York, N. Y.
24	do	do	Do.
27	Buoy shackles	Fletcher & Crowell Co	Portland, Me.
29	Steel	Wyman & Gordon Co	Worcester, Mass.
Oct. 3	do	do	Do.
3	Shackle and swivel	Weatherly Foundry & Machine Co.	Weatherly, Pa.
4	Concrete cubes	Boston Elevated Ry. Co	Boston, Mass.
6	Leather belting	American Belting & Tanning Co.	Do.
7	Breaker links	Plymouth Cordage Co	North Plymouth, Mass.
10	Steel eyebars	A. H. Emery	Stamford, Conn.
11	do	do	Do.
13	do	do	Do.
15	do	do	Do.
17	Steel	Wyman & Gordon Co	Worcester, Mass.
17	Enameled brick	American Enameled Brick & Tile Co.	New York, N. Y.
18	do	do	Do.
18	Concrete building block	Dix. D. Drake	Buffalo, N. Y.
20	do	Gustavo Rappoli	Haverhill, Mass.
22	Steel	Wyman & Gordon Co	Worcester, Mass.
24	do	do	Do.
24	Concrete cubes	Boston Elevated Ry. Co	Boston, Mass.
25	do	do	Do.
27	Column caps	United States Column Co	Cambridge, Mass.
29	Concrete briquettes	Simpson Bros. Corporation	Boston, Mass.
Nov. 2	Steel	Wyman & Gordon Co	Worcester, Mass.
2	Concrete briquettes	Simpson Bros. Corporation	Boston, Mass.
3	Concrete cubes	do	Do.
3	Concrete building blocks.	Henry C. Sawyer	Buffalo, N. Y.
4	Steel	Wyman & Gordon Co	Worcester, Mass.
4	Lally columns	United States Column Co	Cambridge, Mass.
4	Shelf supports	The Snead & Co. Iron Works	Jersey City, N. J.
7	Concrete cubes	Boston Elevated Ry. Co	Boston, Mass.
7	Concrete cubes and briquettes.	Simpson Bros. Corporation	Do.
8	Steel	Wyman & Gordon Co	Worcester, Mass.
10	Manila rope	The Munson Steamship line	New York, N. Y.
11	Concrete cubes	Simpson Bros. Corporation	Boston, Mass.
12	Steel	Wyman & Gordon Co	Worcester, Mass.
17	do	do	Do.
17	Rubber and canvas belting.	Boston Woven Hose & Rubber Co.	Cambridgeport, Mass.
18	Concrete cubes	Boston Elevated Ry. Co	Boston, Mass.
26	Concrete building blocks.	M. E. Smith & Bros	Watertown, Mass.

Tests made for private parties during the fiscal year ended June 30, 1911—Continued.

Date.	Material.	Name.	City and State.
1910.			
Nov. 26	Column caps	United States Column Co	Cambridge, Mass.
28	Granite cubes	Norcross Bros. Co	Worcester, Mass.
28	Concrete building block.	James Roche	Arlington, Mass.
30	Concrete cubes	Boston Elevated Ry. Co	Boston, Mass.
30	Steel	Wyman & Gordon Co	Worcester, Mass.
Dec. 2	Manila rope	The Munson Steamship Line	New York, N. Y.
7	Sash chain	Bridgeport Chain Co	Bridgeport, Conn.
9	Braided cord	Tucker & Carter Rope Co	New York, N. Y.
10	Concrete building block.	Gustavo Rappoli	Haverhill, Mass.
10	Cast-iron shelf supports	The Snead & Co. Iron Works	Jersey City, N. J.
12	Buoy shackles	Fletcher & Crowell Co	Portland, Me.
14	Copper-clad steel wire	Dr. Leonard Waldo	New York, N. Y.
15	do	do	Do.
15	Steel	Wyman & Gordon Co	Worcester, Mass.
16	Concrete cubes	Boston Elevated Ry. Co	Boston, Mass.
16	Steel	Wyman & Gordon Co	Worcester, Mass.
17	do	Hood Rubber Co	Watertown, Mass.
19	Steel fence wire	P. H. Dudley	New York, N. Y.
22	Copper-clad steel wire	Dr. Leonard Waldo	Do.
23	do	do	Do.
24	do	do	Do.
27	Hoist hooks	J. H. Williams & Co	Brooklyn, N. Y.
28	do	do	Do.
29	do	do	Do.
30	do	do	Do.
30	Steel	Wyman & Gordon Co	Worcester, Mass.
31	Hoist hooks	J. H. Williams & Co	Brooklyn, N. Y.
1911.			
Jan. 3	do	do	Do.
3	Copper-clad steel wire	Dr. Leonard Waldo	Do.
4	do	do	Do.
5	do	do	Do.
6	Bronze	Burton F. Reed	Boston, Mass.
6	Steel	Wyman & Gordon Co	Worcester, Mass.
7	Concrete cubes	Boston Elevated Ry. Co	Boston, Mass.
7	Cast-iron shelf supports	The Snead & Co. Iron Works	Jersey City, N. J.
9	do	do	Do.
11	Copper-clad steel wire	Dr. Leonard Waldo	New York, N. Y.
13	Concrete-filled column	E. McCabe & Co	Lawrence, Mass.
14	Fastenings for canvas belting.	Carton Belting Co	Boston, Mass.
18	Concrete cubes	Boston Elevated Ry. Co	Do.
18	Steel	Wyman & Gordon Co	Worcester, Mass.
18	Cast-iron bar	The Portland Co	Portland, Me.
18	Sheet-steel post for metal shelving.	Manufacturing Equipment & Engineering Co.	South Framingham, Mass.
30	Steel	Wyman & Gordon Co	Worcester, Mass.
30	Concrete cubes	Boston Elevated Ry. Co	Boston, Mass.
31	Steel	Wyman & Gordon Co	Worcester, Mass.
Feb. 4	do	do	Do.
8	do	do	Do.
10	Buoy shackles	Fletcher & Crowell Co	Portland, Me.
13	Steel	Wyman & Gordon Co	Worcester, Mass.
14	do	do	Do.
15	do	do	Do.
15	Cast iron	Newport News Shipbuilding & Dry Dock Co.	Newport News, Va.
16	Concrete cubes	Boston Elevated Ry. Co	Boston, Mass.
17	do	do	Do.
17	Steel	Bath Iron Works	Bath, Me.
17	do	J. C. Loring & Co	Boston, Mass.
18	Breaker links	Plymouth Cordage Co	North Plymouth, Mass.
20	Column caps	United States Column Co	Cambridge, Mass.
20	Lally columns	Boston Column Co	Boston, Mass.
21	do	do	Do.
21	Steel	Wyman & Gordon Co	Worcester, Mass.
24	do	do	Do.
27	Bearing metal	Burton F. Reed	Boston, Mass.
27	Cast iron	Newport News Shipbuilding & Dry Dock Co.	Newport News, Va.
28	Steel	James W. Sederquist	Boston, Mass.
28	Bronze	Fort Hill Bronze Manufacturing Co.	West Everett, Mass.
Mar. 9	Concrete cubes	Boston Elevated Ry. Co	Boston, Mass.
10	Lally column	United States Column Co	Cambridge, Mass.
11	Steel eyebars	Pennsylvania Steel Co	Steelton, Pa.

Tests made for private parties during the fiscal year ended June 30, 1911—Continued.

Date.	Material.	Name.	City and State.
1911.			
Mar. 15	Steel	Marlin Firearms Co	New Haven, Conn.
16	Steel fence wire	P. H. Dudley	New York, N. Y.
17	Concrete-filled column.	Louis Miller Co	East Boston, Mass.
17	Concrete cubes	Boston Elevated Ry. Co	Boston, Mass.
20	Buoy shackles	Fletcher & Crowell Co	Portland, Me.
21	Concrete cubes	Boston Elevated Ry. Co	Boston, Mass.
21	Cast-iron shelf supports	The Snead & Co. Iron Works	Jersey City, N. J.
22	....do	....do	Do.
22	Steel eyebars	Pennsylvania Steel Co	Steelton, Pa.
23	....do	....do	Do.
24	....do	....do	Do.
25	....do	....do	Do.
27	....do	....do	Do.
28	Sash chain	Bridgeport Chain Co	Bridgeport, Conn.
28	Links, hooks, and turnbuckles.	The Thomas Laughlin Co	Portland, Me.
29	Steel eyebars	Pennsylvania Steel Co	Steelton, Pa.
30	....do	....do	Do.
31	....do	....do	Do.
Apr. 1	....do	....do	Do.
5	Bearing metal	Burton F. Reed	Boston, Mass.
6	Concrete cubes	Boston Elevated Ry. Co	Do.
6	Concrete building block.	Smith Bros	Watertown, Mass.
6	Concrete	Emerson & Norris Co	Brighton, Mass.
7	....do	....do	Do.
8	....do	....do	Do.
8	Cast iron	Golding Manufacturing Co	Franklin, Mass.
8	Sash chain	Bridgeport Chain Co	Bridgeport, Conn.
12	Steel specimens for calibration of testing machine.	Pennsylvania R. R. Co	Altoona, Pa.
21	Steel bars	Horton & Hemenway Co	Boston, Mass.
22	....do	....do	Do.
25	Concrete cube	City Civil Engineer	Dayton, Ohio.
28	Concrete	Boston Transit Commission	Boston, Mass.
May 1	Brick	J. F. Beedle	Do.
2	Bearing metal	Burton F. Reed	Do.
4	Concrete cubes	Boston Elevated Ry. Co	Do.
9	Manila rope	Whitlock Cordage Co	New York City.
9	Steel	Wyman & Gordon Co	Worcester, Mass.
17	Concrete cubes	Boston Elevated Ry. Co	Boston, Mass.
18	Cast iron	H. J. Crandall & Son Co	East Boston, Mass.
19	Concrete cubes	Boston Elevated Ry. Co	Boston, Mass.
22	Concrete stone	Emerson & Norris Co	Brighton, Mass.
22	Cast iron	Golding Manufacturing Co	Franklin, Mass.
27	Manila rope	Plymouth Cordage Co	North Plymouth, Mass.
June 1	Rubber belt	Revere Rubber Co	Chelsea, Mass.
1	Concrete stone	Emerson & Norris Co	Brighton, Mass.
5	Concrete cubes	Boston Elevated Ry. Co	Boston, Mass.
12	Lally columns	Lally Column Co. of New York	Brooklyn, N. Y.
14	Magnesium	Virginia Electrolytic Co	New York, N. Y.

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